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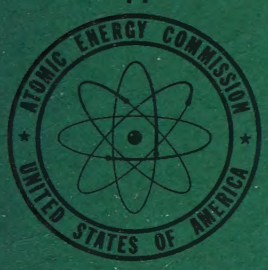

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Indexes

Volumes 1, 2, 3, and 4 of Nuclear Science Abstracts are cumulatively indexed by Author, Subject, and Nuclide in Volume 4, No. 24B, Dec. 30, 1950. The Author, Subject, and Nuclide indexes for Volume 5 of NSA appear in Volume 5, No. 24, Dec. 31, 1951. The cumulative Numerical Index of AEC Reports, described on the inside back cover, is published in Volume 5, No. 24, and includes all reports abstracted in the first five volumes of Nuclear Science Abstracts as well as those abstracted in Abstracts of Declassified Documents.

Each issue of Volume 6(1952) contains an Author Index and a current supplement to the cumulative Numerical Index of Reports. Subject and Author Indexes, cumulated quarterly, are issued as separate supplements to the sixth, twelfth, and eighteenth issues. The 24th issue will be the Cumulative Index for the year.

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ANNOUNCEMENT OF NEW SUPPLEMENT IN NUCLEAR SCIENCE ABSTRACTS

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

National Bureau of Standards Group: K. Way, G. H. Fuller, M. Wood, K. Thew, and A. Jurgens

Readers: G. Friedlander and G. Scharff-Goldhaber, Brookhaven National Laboratory; P. Axel and R. B. Duffield, University of Illinois; J. R. Stehn, Knolls Atomic Power Laboratory; J. S. Smart, Naval Ordnance Laboratory; L. Slack, Naval Research Laboratory; H. Pomerance, F. D. McGowan, and H. Zeldes, Oak Ridge National Laboratory.

In collaboration with the National Bureau of Standards Nuclear Data Group Nuclear Science Abstracts is publishing regularly summaries of new nuclear data. The tabular style adopted will make it possible for readers to find quickly new values for the properties of stable and radioactive nuclei and to incorporate these values into existing tables or compilations.

The plan is to have each issue of NSA carry a data summary for information published during a two-week period. It is hoped that eventually this two-week period will precede the NSA date of issue by not more than two months. Four times a year NSA will cumulate these summaries into large tables in which all new information reported in a three-month period will be arranged by element and isotope.

When the collaboration was decided upon last fall, the NBS group had on hand summaries of the data reported during September 1951. In order to get the plan into prompt operation, it was decided to start with this available material and carry a little more than two week's results for the first few issues until the time lag between publication of data and summarization has become as short as possible. The first cumulation in Vol. 6, No. 6B of March 31, 1952, will cover all nuclear data made available between July 1, 1951, and approximately December 1, 1951. The third Supplement to "Nuclear Data," NBS Circular 499, which is now in press, will cover data reported between January 1, 1951, and July 1, 1951.

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ERRATA

NSA, Vol. 6, No. 2. In the Reports Reference List, the title of NEPA-1701 should refer to NaI-TlI crystals.

NSA, Vol. 6, No. 2. In abstract 496, the third sentence should read: "Radioautographs made of the livers of rats administered C^{14}-labeled stilbamidine tend to confirm histochemical evidence that stilbamidine is retained in the mitochondria of the liver cells."

NSA, Vol. 6, No. 2. In abstract 526, third line of the text, Ca^{245} should be Ca^{45}.

NSA, Vol. 6, No. 2. In abstract 530, the statement "The report is reproduced here in its entirety" was omitted.

NSA, Vol. 6, No. 2. In abstract 570, C-Curarube should be C-Curarine.

REPORTS REFERENCE LIST

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TREATMENT OF RADIOACTIVE WASTE SOLUTIONS; by [Charles E. Hirsch.] [nd] Decl. with deletions Jan. 4, 1952. 8p. (AECD-3291)

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EVALUATION OF A COTTRELL ELECTROSTATIC PRECIPITATOR ON A RADIOCHEMICAL PROCESS OFF-GAS SYSTEM, by J. C. Suddath. Issued Nov. 26, 1951. Decl. without deletions Jan. 14, 1952. 39p. (AECD-3295; ORNL-1082)

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REPORT FOR GENERAL RESEARCH; JULY 30, 1951, TO OCTOBER 29, 1951; by M. M. Haring, Director. Dec. 3, 1951. 24p. (MLM-630)

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A SIMPLIFIED APPROACH TO REACTOR CALCULATION, p.152-175 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by A. V. Masket. Dec. 1951. (TID-5031(p.152-175))

TID-5031(p.176-209) 1095
Oak Ridge National Lab.
STANDARDS OF RADIOLOGICAL PROTECTION AND CONTROL, p.176-209 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Karl Z. Morgan. Dec. 1951. (TID-5031(p.176-209))

TID-5031(p.210-243) 1320
Oak Ridge National Lab.
CHEMICAL PROBLEMS IN THE DEVELOPMENT OF NUCLEAR REACTORS, p.210-243 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by J. A. Swartout. Dec. 1951. (TID-5031(p.210-243)

TID-5031(p.244-271) 1282
Massachusetts Inst. of Tech.
SEPARATION OF STABLE ISOTOPES, p.244-271 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Manson Benedict. Dec. 1951. (TID-5031(p.244-271))

TID-5031(p.272-301) 1189
Oak Ridge National Lab.
MATERIALS OF REACTOR CONSTRUCTION, p.272-301 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by G. E. Evans. Dec. 1951. (TID-5031(p.272-301))

TID-5031(p.302-310) 1201
Oak Ridge National Lab.
HEAT TRANSFER PROBLEMS IN NUCLEAR REACTORS, p.302-310 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Richard N. Lyon. Dec. 1951. (TID-5031(p.302-310))

TID-5031(p.311-331) 1321
Tennessee Univ.
INSTRUMENTATION AND CONTROL OF REACTORS, p.311-331 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by J. D. Trimmer. Dec. 1951. (TID-5031(p.311-331))

TID-5031(p.332-352) 1360
Oak Ridge National Lab.
NUCLEAR RADIATION SHIELDING PRINCIPLES, p.332-352 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by E. P. Blizard. Dec. 1951. (TID-5031(p.332-352))

TID-5031(p.353-399) 1212
Oak Ridge National Lab.
ENVIRONMENTAL PROBLEMS OF RADIOACTIVE WASTE MATERIALS, p.353-399 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Roy J. Morton. Dec. 1951. (TID-5031(p.353-399))

TID-5031(p.400-409) 1213
Oak Ridge National Lab.
THE TREATMENT OF RADIOACTIVE WASTES, p.400-409 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by W. K. Eister. Dec. 1951. (TID-5031(p.400-409))

TID-5031(p.411-421) 1322
North American Aviation, Inc.
HAZARDS OF LOW POWER RESEARCH REACTORS, p.411-421 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by M. M. Mills. Dec. 1951. (TID-5031(p.411-421))

TID-5031(p.422-449) 1323
Oak Ridge National Lab.
A SURVEY OF REACTOR TYPES, p.422-449 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Neal F. Lansing. Dec. 1951. (TID-5031(p.422-449))

TID-5031(p.453-459) 1190
Oak Ridge National Lab.
THE SCOPE OF NUCLEAR ENGINEERING, p.453-459 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by A. M. Weinberg. Dec. 1951. (TID-5031(p.453-459))

TID-5031(p.459-463) 1191
California Univ., Los Angeles
THE IMPACT OF ATOMIC ENERGY UPON THE TRAINING OF THE PROFESSIONAL ENGINEER, p.459-463 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by L. M. K. Boelter. Dec. 1951. (TID-5031(p.459-463))

TID-5031(p.463-471) 1192
Oak Ridge National Lab.
THE OAK RIDGE SCHOOL OF REACTOR TECHNOLOGY AND DEVELOPMENT ENGINEERING EDUCATION, p. 463-471 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by F. C. Vonderlage. Dec. 1951. (TID-5031(p.463-471))

TID-5031(p.471-475) 1193
Louisville Univ.
REPORT ON PRELIMINARY SURVEY OF CURRENT NUCLEAR ENGINEERING COURSES, p. 471-475 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Robert Ernst. Dec. 1951. (TID-5031(p.471-475))

TID-5031(p.475-485) 1194
North Carolina State Coll.
TRAINING IN NUCLEAR ENGINEERING, p. 475-485 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Clifford Beck. Dec. 1951. (TID-5031(p.475-485))

UCLA-174 1343
Atomic Energy Project, Univ. of Calif., Los Angeles
ENERGY ADSORPTION BY EXTERNALLY IRRADIATED LIQUIDS; by Stanley L. Whitcher. Issued Dec. 20, 1951. 44p. (UCLA-174)

UCRL-1575 1344
Radiation Lab., Univ. of Calif.
THE SELF-SCATTERING AND SELF-ABSORPTION OF BETA PARTICLES BY MODERATELY THICK SAMPLES; by W. E. Nervik and P. C. Stevenson. Nov. 21, 1951. 23p. (UCRL-1575)

UCRL 1581 1326
Radiation Lab., Univ. of Calif.
INTERPRETATION OF EXPERIMENTS ON THE PHOTO-NUCLEAR EFFECT IN HEAVY ELEMENTS; by L. Eyges. Nov. 30, 1951. 32p. (UCRL-1581)

UCRL-1585 1324
Radiation Lab., Univ. of Calif.
SUMMARY OF RESEARCH PROGRESS MEETING OF OCTOBER 4, 1951; by Sergey Shewchuck. Nov. 30, 1951. 4p. (UCRL-1585)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE-G/R-784 1185
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DESIGN OF MASS FLOWMETERS FOR LARGE FLOWS; FLOW-SHUNTS; by H. Kronberger. Oct. 18, 1951. 14p. (AERE-G/R-784)

AERE-M/R-790 1227
Atomic Energy Research Establishment, Harwell, Berks (England)
FORMATION AND POLARISATION OF ANODIC OXIDE FILMS ON TANTALUM ELECTRODES; by L. Young. Sept. 28, 1951. 17p. (AERE-M/R-790)

AERE-M/R-791 1228
Atomic Energy Research Establishment, Harwell, Berks (England)
THE EXAMINATION OF METALS UNDER POLARISED LIGHT; PART IV. APPLICATION TO A STUDY OF VARIOUS ANISOTROPIC METALS AND INTERMETALLIC PHASES; by B. W. Mott and H. R. Haines. Oct. 16, 1951. 29p. (AERE-M/R-791)

AMRL-69 1075
Army Medical Research Lab.
THYROID AND ADRENAL RESPONSE TO VARYING DOSE LEVELS OF EPINEPHRINE; by A. L. Botkin and J. T. Tew. Dec. 3, 1951. 8p. (AMRL-69; Report No. 69)

BM-RI-4826 1229
Bureau of Mines
ZIRCONIUM-TITANIUM SYSTEM; CONSTITUTION DIAGRAM AND PROPERTIES; by Earl T. Hayes, A. H. Roberson, and O. G. Paasche. November 1951. 21p. (BM-RI-4826)

JPL-Memo-3-4 1065
Jet Propulsion Lab., Calif. Inst. of Tech.
PROBLEMS IN THE APPLICATION OF NUCLEAR ENERGY TO ROCKET PROPULSION; MEMORANDUM; by H. S. Seifert and M. M. Mills. Jan. 23, 1947. 11p. (JPL-Memo-3-4)

JPL-PR-1-52 1164
Jet Propulsion Lab., Calif. Inst. of Tech.
A CALORIMETER FOR CORROSIVE LIQUIDS; PROGRESS REPORT; by B. H. Sage and E. W. Hough. June 16, 1947. 36p. (JPL-PR-1-52)

JPL-PR-1-66 1196
Jet Propulsion Lab., Calif. Inst. of Tech.
AN EXPERIMENTAL STUDY OF THE FLOW OF GAS THROUGH POROUS METALS; by Pol Duwez and H. L. Wheeler, Jr. Aug. 7, 1947. 50p. (JPL-PR-1-66)

JPL-PR-1-67 1230
Jet Propulsion Lab., Calif. Inst. of Tech.
THE GAS PERMEABILITY OF SOME COMMERCIALLY AVAILABLE POROUS METALS; PROGRESS REPORT; by Pol Duwez. Aug. 8, 1947. 32p. (JPL-PR-1-67)

JPL-PR-1-71 1231
Jet Propulsion Lab., Calif. Inst. of Tech.
PREPARATION AND PHYSICAL PROPERTIES OF POROUS IRON; PROGRESS REPORT; by Pol Duwez and H. E. Martens. Aug. 29, 1947. 50p. (JPL-PR-1-71)

JPL-PR-4-85 1232
Jet Propulsion Lab., Calif. Inst. of Tech.
THE PERMEABILITY OF POROUS IRON; PROGRESS REPORT; by Leon Green, Jr., and Pol Duwez. Feb. 9, 1949. 26p. (JPL-PR-4-85)

JPL-PR-4-93 1233
Jet Propulsion Lab., Calif. Inst. of Tech.
PREPARATION AND PHYSICAL PROPERTIES OF POROUS IRON-NICKEL ALLOY; PROGRESS REPORT; by Howard E. Martens. Mar. 4, 1949. 24p. (JPL-PR-4-93)

JPL-PR-4-97 1234
Jet Propulsion Lab., Calif. Inst. of Tech.
A METHOD FOR MACHINING POROUS METALS; by H. L. Wheeler, Jr. Apr. 15, 1949. 8p. (JPL-PR-4-97)

(NACA-TN-2586) 1207
Michigan Univ.
FUNDAMENTAL EFFECTS OF COLD-WORK ON SOME COBALT-CHROMIUM-NICKEL-IRON BASE CREEP-RESISTANT ALLOYS; by D. N. Frey, James W. Freeman, and Albert Easton White. Jan. 1952. 12p. (NACA-TN-2586)

NBS-D-105(extract) 1279
National Bureau of Standards
DEVELOPMENT OF HIGH VOLTAGE BATTERY OF THE ZAMBONI PILE TYPE, extract from QUARTERLY PROGRESS REPORT TO THE U. S. ATOMIC ENERGY COMMISSION; JULY, AUGUST, AND SEPTEMBER, 1951. [nd] 9p. (NBS-D-105(extract))

NEPA-1864 1316
NEPA Div., Fairchild Engine and Airplane Corp.
A HIGH TEMPERATURE FURNACE FOR USE IN NEUTRON REACTORS; by W. E. Browning, L. Martel Bratcher, and H. T. King. Mar. 16, 1951. 9p. (NEPA-1864)

NP-1788 1198
Christ's Coll., Cambridge Univ. (England)
HEAT TRANSFER PROPERTIES OF LIQUID METALS; by Lloyd MacGregor Trefethen. July 1, 1950. 222p. (NP-1788)

NP-3552 1302
Spectroscopic Lab., Univ. of Chicago
REPORT FOR PERIOD APRIL 1, 1950, TO MARCH 31, 1951; PART II. [nd] 297p. (NP-3552; U-18908)

NP-3553 1235
Institute of Engineering Research, Univ. of Calif.
ON THE CORRELATION BETWEEN CREEP AND TENSILE PROPERTIES OF DILUTE ALPHA SOLID SOLUTIONS OF ALUMINUM; by Oleg D. Sherby and John E. Dorn. Nov. 15, 1951. 44p. (NP-3553)

NP-3566 1097
Naval Medical Research Inst., Bethesda
NEWER CONCEPTS OF RADIATION SICKNESS AND ITS TREATMENT; by F. Ellinger. May 23, 1951. 18p. (NP-3566; Lecture and review series No. 51-6; R5826)

NP-3568 1236
Metals Corrosion Lab., Bureau of Mines
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; MONTHLY REPORT FOR SEPTEMBER 1951; by L. B. Golden, D. Schlain, I. R. Lane, Jr., W. L. Acherman, and W. Mace. [nd] 8p. (NP-3568)

NP-3579 1199*
Massachusetts Inst. of Tech.
HEAT TRANSFER TO MERCURY (thesis); by Robert J. Musser and William R. Page. May 23, 1947. 60p. (NP-3579)

NP-3588 1220
Department of Mines and Technical Surveys (Canada)
EQUILIBRIUM ASSAYING OF URANIUM ORE; by John W. Hilborn. Dec. 1, 1951. 28p. (NP-3588; Topical Report 92/51)

NRL-3894 1237
Naval Research Lab.
SOLUBILITY OF OXYGEN IN POTASSIUM METAL AND SODIUM-POTASSIUM ALLOYS; by Dale D. Williams. Dec. 19, 1951. 18p. (NRL-3894)

NRL-3918 1218
Naval Research Lab.
CORROSION OF BRASS-RETAINER BALL BEARINGS; by Hayward R. Baker. Dec. 20, 1951. 9p. (NRL-3918)

TEI-153-A 1136
Geological Survey
FLUORIMETRIC DETERMINATION OF URANIUM IN SHALES, LIGNITES, AND MONAZITES AFTER ALKALI CARBONATE SEPARATION; by Norma S. Guttag and F. S. Grimaldi. Oct. 1951. 18p. (TEI-153-A)

GENERAL

ATOMIC BOMBS AND WARFARE

1065

THE ADMINISTRATION OF JUSTICE AND THE A-BOMB: WHAT FOLLOWS DISASTER? Homer D. Crotty. Am. Bar Assoc. J. 37, 893-6(1951) Dec.

Possible effects of an atomic bomb attack upon our government and our legal system above and beyond the immediate chaos following the attack are discussed.

ATOMIC POWER

1066

Jet Propulsion Lab., Calif. Inst. of Tech.

PROBLEMS IN THE APPLICATION OF NUCLEAR ENERGY TO ROCKET PROPULSION; MEMORANDUM; by H. S. Seifert and M. M. Mills. Jan. 23, 1947. 11p. (JPL-Memo-3-4)

The possibility is discussed of using nuclear energy to achieve rocket propulsion at velocities higher than those possible by use of conventional chemical reactions. There are three conceptually possible techniques: the use of fission fragments, radiation pressure, and an inert working fluid. Of these, only the latter is deemed practical. The ballistic performance of a single-step rocket in field-free space is examined in order to compare the conventional and nuclear power sources. Simple equations are derived which indicate that the exhaust velocity depends on the total mass of working fluid, whereas in chemical propellants it is independent of the mass. It appears that the practical plan for achieving maximum terminal velocity is to build a rocket with the loading factor (percentage of total mass in the form of expendable working fluid) as high as possible and then carry along enough nuclear energy to heat the working fluid to the limiting temperature. The full use of a nuclear energy source cannot be made until it is possible to remove restrictions on the temperatures which may be handled.

1067

REMARKS ON ENERGY PROBLEMS. Otakar Maštovský. Sborník Masarykovy Akad. Práce 25, 1-13(1951). (In Polish)

The exploitation of natural energy resources as a condition of cultural and social progress is discussed. Some selected data on world energy consumption are given. The share supplied by water power is discussed, and new hydroelectric plants, especially in the U.S.S.R., are mentioned, as is the design and economy of modern steam power stations. Development of district heating, production of lighting gas in the Lurgi gas works, underground gasification of coal, and electricity from galvanic and thermal elements are touched on. The possibility of nuclear energy is considered briefly.

1068

ATOMIC CENTRAL HEATING SYSTEM AT HARWELL. Engineer 192, 689(1951) Nov. 30.

The first atomic central heating plant has been inaugurated at AERE, Harwell, where a building containing eighty offices draws heat directly from BEPO. Very little technical information is given, but an outline of the system is diagramed.

1069

THE ATOMIC ENERGY INDUSTRY: AN EXPERIMENT IN HYBRIDIZATION. James R. Newman. Yale Law J. 60, 1263-394(1951) Dec.

The organization, structure, and functioning of the Atomic Energy Commission is discussed in detail.

BIOLOGY AND MEDICINE

1070

Oak Ridge National Lab.

OXIDATIVE REACTIONS IN THE PROPIONIC ACID FERMENTATION (abstract); by S. F. Carson and Eugene A. Delwiche. [nd] 1p. (AECU-1795)

Previous studies (Delwiche and Carson, unpublished) on the propionic acid fermentation have demonstrated that Propionibacterium pentosaceum contains enzymes which are typical of a tricarboxylic acid cycle. The presence of aconitase and isocitric dehydrogenase was shown by the conversion (in cell juices) of citrate to α-ketoglutarate with the uptake of one-half mole of oxygen per mole of citrate utilized; α-ketoglutarate was isolated and identified. A wide variety of substrates were oxidized with the uptake of molecular oxygen; addition of coenzyme A accelerated oxidations by acetone-dried cells. Present studies demonstrated that acetone-dried cells were capable of carrying out the following reaction: acetate + oxalacetate → citrate. Isotope experiments were performed on "resting cell suspensions" (aerobically grown cells) with labeled acetate, ethanol, and pyruvate. Citrate, α-ketoglutarate, succinate, pyruvate, propionate, malate, and acetate were isolated, purified, and degraded to individual carbon fragments. The results clearly fall in line with predictions based upon current concepts of the tricarboxylic acid cycle; for example, with ethanol-2-C^{14} as substrate in the presence of an arsenite block, the α-ketoglutarate which was isolated and degraded was found to contain 93% of its labeling in the Δ position (C-4). Incidentally, this distribution of labeling is an excellent example of the Ogston effect. Experiments with acetate-2-C^{14} and pyruvate-2-C^{14} have confirmed and extended these observations.(Entire report)

1071

Oak Ridge National Lab.

A TRANSMISSIBLE DISEASE IN MICE CHARACTERIZED BY ANEMIA, LEUKOPENIA, AND ERYTHROPOIETIC SPLENOMEGALY (abstract); by A. C. Upton and J. Furth. [nd] 1p. (AECU-1800)

A disease characterized by anemia, leukopenia, and extensive erythropoiesis in the spleen, with splenomegaly, has been transmitted in 20 passages (6 subpassages). This disease was encountered in a female mouse and transmitted by intraperitoneal injections of particles of involved spleens. The interval between inoculation and appearance of symptoms has been constantly about 3 to 5 months. The course of the disease has been typically chronic, the splenomegaly and anemia progressing gradually for several months prior to the death of the animal. The size of

the spleen usually exceeds 35 by 15 mm in the two greatest dimensions, the enlargement being due principally to erythropoiesis. Leukemic infiltrations are lacking, and hemopoiesis in the bone marrow does not appear to be disturbed. Some blood destruction is indicated by hemosiderosis and erythrophagocytosis in macrophages of spleen, lymph nodes, and bone marrow. There is erythroblastosis and reticulocytosis of the peripheral blood, and the erythrocyte counts drop below one million. Thus far no organisms have been demonstrated in histologic sections or blood films. Attempts are being made currently to establish the nature and causative agents of this disease. (Entire report)

1072

Iowa State Coll.

THE METABOLIC RELATION BETWEEN METHIONINE AND ADENINE THIOMETHYLRIBOSIDE IN YEAST; by Raymond L. Smith and F. Schlenk. [nd] 18p. (AECU-1808)

Adenine thiomethylriboside is accumulated in growing yeast if the medium contains large amounts of methionine. Sulfate, cysteine, glutathione, and homocystine cannot replace methionine. The adenine supply is not a critical factor in accumulation of the nucleoside in yeast. When yeast rich in adenine thiomethylriboside is transferred into a medium containing no methionine the nucleoside disappears gradually. The biological implications of these observations are discussed. (auth)

1073

Minnesota Univ.

ABNORMAL SPORE GERMINATION AND MICROTHALLUS DEVELOPMENT OF FUNGI INDUCED BY DILUTE COLLOIDAL POLONIUM (abstract); by Edward E. Butler and John B. Rowell. [nd] 2p. (AECU-1813)

Aqueous suspensions of spores or vegetative cells of several fungi were immersed with extremely dilute polonium, approximately 0.5 μc/ml, for 6 to 21 days at 8°C. The cells were tested for viability at regular intervals during this exposure by placing samples on nutrient agar. Cells receiving sufficient doses of α radiation by such treatment lost the capacity to produce a living colony but would develop abnormally before all growth processes ceased. Protoplasm of such microthalli had a characteristically dense refractive appearance when viewed with transmitted light.

The characteristics of this phenomenon vary in different fungi. In Aspergillus niger and Penicillium oxalicum many conidia became excessively swollen, producing giant cells 15 to 30 μ in diameter which failed to develop further. Other conidia germinated by short swollen germ tubes 10 to 60 μ in length. Germ tubes frequently terminated in a vesicle which burst or remained inflated until disintegration occurred. Ascospores of Chaetomium globosum germinated to produce short, apically inflated or apparently normal germ tubes, but general hyphal swelling was lacking. Vegetative cells of Saccharomyces cerevisine and sporidia of Ustilago zeae became greatly enlarged and one or two cell divisions occurred before growth ceased. The development of a limited, morphologically abnormal thallus was especially pronounced in Mucor recurvus (Butler, Edward E. A new species of Mucor. Mycologia (in press)). In this species, large, grotesquely swollen, much branched microthalli were produced upon germination of sporangiospores. The mean linear extension of the microcalonies was inversely proportional to time of exposure to polonium. With longer spore treatment there was progressively less and less development until the spores merely swelled or remained inactive. (Entire report. Abstract of paper for Minneapolis annual meeting of Botanical Society of America, 1951.)

1074

Montefiore Hospital, New York

ELECTROPHORETIC ANALYSIS OF SERUM AND URINARY PROTEINS IN DIABETIC GLOMERULOSCLEROSIS; by Harold Rifkin and Mary L. Petermann. Montefiore Hospital and Sloan-Kettering Inst. for Cancer Research. [nd] 11p. (AECU-1815)

In every one of ten patients with diabetic glomerulosclerosis, there was a significant elevation in the serum alpha-2 globulin. Since in diabetes mellitus, uncomplicated by the specific renal lesion, the alpha-2 globulin is within normal limits, the possibility is suggested that the abnormal electrophoretic pattern may have a pathogenetic significance. (auth)

1075

Army Medical Research Lab.

THYROID AND ADRENAL RESPONSE TO VARYING DOSE LEVELS OF EPINEPHRINE; by A. L. Botkin and J. T. Tew. Dec. 3, 1951. 8p. (AMRL-69; Report No. 69)

The smallest intraperitoneal dose of epinephrine which produces a significant response from the thyroid and adrenal glands of the rat in two hours (as measured by I^{131} concentration and cholesterol content respectively) is 20 μg. The responses observed with varying levels of epinephrine are quantitatively similar for the two glands and are approximately parallel between doses of 20 and 100 μg of epinephrine. This is interpreted as an increased rate of function of both glands. Various explanations of these findings are discussed. (auth)

RADIATION EFFECTS

1076

Oak Ridge National Lab.

MORPHOLOGY OF TRANSPLANTABLE PITUITARY TUMORS INDUCED BY RADIOACTIVE IODINE AND THE ASSOCIATED SECONDARY CHANGES (abstract); by J. Furth. [nd] 1p. (AECU-1791)

All five strains of transplantable pituitary tumors induced in mice by I^{131} are composed of chromophobe cells with only a rare, faintly basophile cell. Nevertheless they all secrete thyrotropic and gonadotropic hormones. The changes indicative of these secretions in tumor-bearing hosts and in bioassays will be demonstrated. These include hyperplasia of the thyroid with features of grave hyperthyroidism, extensive ovarian changes as seen in pregnancy tests, and hyperplasia of Leydig cells. A novel finding is that tremendous cystic dilatation the common duct is associated with hyperplasia of ductal epithelium. This change, frequently leading to spontaneous rupture, occurs terminally in every animal bearing a grafted tumor. These and other characteristic changes will be illustrated and the mechanism of neoplasia induction in endocrine organs by ionizing irradiations discussed. (Entire report. Abstract of paper for N.Y. meeting of Am. Assoc. of Pathology and Bacteriology, Apr. 10-12, 1952.)

1077

Oak Ridge National Lab.

ELECTROLYTES IN MUSCLE OF RAT FORELIMB AFTER INTENSE LOCAL X IRRADIATION (abstract); by W. S. Wilde and C. W. Sheppard. Oak Ridge National Lab. and Tulane Univ. [nd] 1p. (AECU-1796)

Wistar adult male rats under nembutal were secured under a 13-mm lead-plate shield containing a window for exposure of the muscles of one forelimb to x rays (single doses, 250 kvp, 10 to 73 kr; rate 720 r/min, 30 mm from shutter and filtered through 3 mm Al; scatter to other parts of animal 0.11% of dosage). Companion muscle from the other shielded forelimb served as control against indirect influences which might arise from whole-body ef-

fects of scattered radiation. For many hours after exposure, the animal continued to use the limb freely. The rayed muscle, sampled 22 hr after exposure began, showed swelling but no other visible evidence of damage and remained functional. All analyses were expressed per 250 g dry weight of muscle completely cleaned of fat and membranous and tendinous connective tissue. Changes would otherwise be masked by swelling. Total water of the exposed muscle increased with dosage to exceed controls by 25%. Potassium content remained unchanged. Simultaneous inulin and Na^{24} spaces in a separate group of rats, nephrectomized at 22 hr to prevent urinary loss of inulin, proved that the water gain was entirely interstitial. Gain in total water and gain in Na^{24} and inulin space were all three equal. Shielded control muscles from all rats collectively showed no changes correlated with total-body irradiation such as might occur from scatter. Thus water, K, and Na were unchanged in exposed muscle fibers, but edema occurred because of local vascular disturbances. (Entire report)

1078

Oak Ridge National Lab.

THE EFFECT OF HYPOXIA ON THE RADIATION INDUCTION OF DEVELOPMENTAL ABNORMALITIES IN THE MOUSE (abstract); by Liane Brauch Russell, W. L. Russell, and Mary H. Major. [nd] 1p. (AECU-1799)

Several investigations have shown that hypoxia protects against various types of radiation damage (chromosome breakage, sex-linked lethal mutations, immediate lethality). To determine whether protection can also be achieved against radiation induction of developmental abnormalities (previously studied by us in a survey of the entire gestation period), mouse embryos at equal developmental stages were exposed to various doses of x rays in either 5% O_2 + 95% He or 21% O_2 + 79% He (i.e., oxygen per cent equivalent to air), having also been preflushed with the respective gas mixture 10 min prior to raying. Doses used were 0, 100, 200, 300, or 400 r. Irradiation was administered by whole-body exposure to the pregnant mothers: C57B females fertilized 11½ days before by NB males. Our earlier work on critical periods had shown this stage to be convenient for quick assays of differences. The 460 newborns obtained were examined externally, then processed for detailed skeletal study. Hypoxia in itself has no effect on the embryo under the conditions administered. Combined with irradiation, however, it exerts marked protection against damage in all the characters radiosensitive on day 11½ that have so far been studied. These include birth weight, viability, tail length, tail shape, and fore- and hind-foot structure. Detailed skeletal findings will be described in the future. The magnitude of protection is similar for all the characters so far tabulated, the median abnormality doses in the 5% O_2 mixture ranging from roughly 100 to 160% above those in the 21% O_2 mixture. (Entire report)

1079

Oak Ridge National Lab.

THE EFFECT OF X RADIATION ON THE RESPIRATION OF BACTERIAL CELLS (abstract); by Daniel Billen, G. E. Stapleton, and Alexander Hollaender. [nd] 1p. (AECU-1801)

Studies with x rays revealed that one effect was inhibition of the respiratory system of washed suspensions of Escherichia coli, although the magnitude of the inhibition varies with substrate, temperature, and strain of the organism used. It was found that a dose of 60,000 r, while decreasing the number of viable cells of a suspension of E. coli B/r by more than 99.95%, had no apparent effect on the initial respiratory rate of the exposed cells. However, the initial period of normal activity was followed by a marked decline in oxygen consumption rate as compared to the control cells. The period of normal activity was longer when pyruvate and succinate were used as substrates as compared to glucose utilization. A period of normal respiratory activity on glucose in contrast to an immediate inhibition of oxidative activity on pyruvate was observed with E. coli (Texas). Both exposed and nonexposed cells showed a respiratory quotient of one on glucose, although the former required a longer period of time to complete the oxidation of the substrate. Holding the exposed cells in buffer at 37°C for 60 min before adding substrate decreased the period of normal activity and caused a sharper decline in respiratory rate, while an exposed suspension held in buffer at 2°C for 3 hr following irradiation was as active as a suspension tested immediately after exposure. A comparison of exposed cells respiring at 37 and 26°C in the presence of glucose or pyruvate revealed an increased adverse effect of the radiation-induced inhibition of respiration at the higher temperature. (Entire report)

1080

Oak Ridge National Lab.

CONDITIONS OF TRANSPLANTATION AND HORMONAL SECRETIONS OF PITUITARY TUMORS INDUCED BY I^{131} (abstract); by J. Furth, W. T. Burnett, Jr., E. Gadsden, and J. N. Dent. [nd] 1p. (AECU-1803)

Tumor-like growths induced in the pituitary by I^{131} are readily transplantable in similarly treated hosts and metastasize to regional lymph nodes, but only one of five strains of tumors so established by successive transplantations in I^{131}-treated hosts proved transplantable in normal hosts. Tadpole assays and morphological changes in hosts bearing such tumor grafts gave evidence for the secretion of thyroid-simulating and gonadal hormones. The dependency of pituitary growth on the lack of thyroid function is indicated by failure of the tumors to grow in normal hosts, with the exception of one strain, and by the atrophy of the tumors following administration of thyroid hormone. A puzzling change in all hosts bearing large tumors consists in hyperplasia of extrahepatic biliary ducts notably of the ampulla and a tremendous cystic dilation of these ducts. There are no data in the literature relating pituitary hormones directly to the biliary tract. This carcinogenesis is a clear example of how lack of a hormone leads to proliferation of cells responsible for the maintenance of that hormone, and how stimulation leads to conditioned and occasionally to autonomous growth. (Entire report)

1081

Bowman Gray School of Medicine, Wake Forest Coll.

THE PROTECTIVE ROLE OF PYRIDOXIN AGAINST THE TOXIC EFFECTS OF P^{32} (abstract); by Camillo Artom, W. E. Cornatzer, and George T. Harrell, Jr. [nd] 1p. (AECU-1811)

In a continuation of our previous studies on the effects of internal radiation by P^{32} as related to various dietary factors, the role of pyridoxin has now been investigated. Mice placed on various experimental diets and receiving a mixture of B vitamins without pyridoxin were injected with a single dose of radioactive phosphate (5-6 μc/g). In the groups on low-protein diets (in which the vitamin deficiency was presumably slight or not yet developed) the a administration of pyridoxin did not affect the survival of the animals. On the contrary a marked protection by pyridoxin was observed in experiments in which the vitamin deficiency was made more severe by adding a pyridoxin analog (desoxypyridoxin) to the low-protein diet, or by increasing the metabolic demand for the vitamin (high-protein diets with added cystine or methionine). For instance, in the groups receiving pyridoxin together with its analog, the day of 50% deaths was shifted from the 14th to beyond the 42nd,

and average time of survival from 19 to 33 days, and the proportion of survivors at the end of the 3rd week from 19 to 77%. These differences are larger than those which might result from a simple additive effect of internal radiation and vitamin deficiency. (Entire report. Abstract of paper for Atlanta meeting of Southeastern Sect. of the Society for Experimental Biology and Medicine, Winter, 1952).

1082

Argonne National Lab.

FACTORS MODIFYING THE EFFECT OF X IRRADIATION ON REGRESSION OF A TRANSPLANTED LYMPHOSARCOMA; by Joanne Weikel Hollcroft, Egon Lorenz, and Marion Matthews, National Cancer Institute, and Argonne National Laboratory. Oct. 25, 1951. 27p. (AECU-1819; UAC-458)

A synergistic effect on regression of a transplanted mouse lymphosarcoma occurred after simultaneous systemic and local tumor irradiation and was absent when the blood supply of the tumor was clamped off during systemic irradiation. The synergistic effect disappeared rapidly when the time interval between systemic and local tumor irradiation was increased from 0 minutes to four hours. Starving the animals for 20 hours before and during local irradiation of the tumor was found to increase tumor regression, while starvation following irradiation had no effect. H_2O_2 administered intravenously to the tumor-bearing animals immediately before tumor irradiation increased the effect on tumor regression in comparison with non-injected, irradiated controls, but hydrogen peroxide administered after irradiation did not. H_2O_2 injected five minutes before irradiation did not significantly increase tumor damage. Irradiation of the tumors of mice kept in a high-oxygen atmosphere produced a greater regression and irradiation of the tumors of mice in a low-oxygen atmosphere produced less regression than irradiation of the tumors of mice breathing air. Clamping off the blood supply to the tumor during local irradiation of the tumor had no effect on tumor regression. (auth)

1083

Argonne National Lab.

THE EFFECT OF SELECTIVE SHIELDING OF RABBIT INTESTINE DURING TOTAL BODY IRRADIATION; by Richard S. Farr and Peter P. H. DeBruyn, University of Chicago and Argonne National Laboratory. Oct. 1951. 11p. (AECU-1820; UAC-459)

Rabbits have been exposed to irradiation with x rays while most of the colon or small intestine was surgically exteriorized into a lead chamber. The results indicate that the selective shielding of the rabbit intestine during otherwise total-body irradiation does not decrease the lethal effects of x rays. It is suggested that the protection conferred on animals when the entire abdomen is shielded during otherwise total-body irradiation can best be attributed to a summation of several "organ effects" rather than to one specific organ. (auth)

1084

Argonne National Lab.

CELLULAR RESPIRATION, CELL DIVISION, AND IONIZING RADIATIONS; by E. S. Guzman Barron and S. Louise Seki, Argonne National Laboratory, and University of Chicago. Oct. 1951. 13p. (AECU-1821; UAC-462)

On x irradiation of the eggs and sperm of Arbacia punctulata there was inhibition of respiration with relatively large doses, whereas there was an increase with small doses. The dose required to produce an increase of respiration depended on the degree of sensitivity of the cell to the effect of ionizing radiation. Sperm cells were most sensitive; then came fertilized eggs; unfertilized eggs were the least sensitive. The inhibiting effect of x rays on cells division was observed even on irradiation with x-ray doses which produced an increase of respiration. These results are compared to similar effects produced by thiol reagents and are attributed to oxidation of the thiol compounds in the cell. (auth)

1085

Minnesota Univ.

THE MUTAGENIC ACTION OF DILUTE COLLOIDAL POLONIUM ON FUNGI; by J. B. Rowell, E. C. Stakman, and E. E. Butler. [nd] 6p. (AECU-1823)

Extremely dilute quantities of polonium 210 (0.5 to 1.0 μc/ml) readily induced mutation in vegetative cells or spores of various fungi in aqueous suspensions held at 8°C for appropriate periods of time. Spores germinated directly in water containing 1 μc of polonium per ml will grow and produce normal colonies. Lethal and mutagenic effects do not appear until the cells are held in this mixture at low temperatures over a long period of time. The effective length of time of exposure varied with the species of organism tested. In simultaneous trials with Ustilago zeae, Saccharomyces cereviseae, Chaetomium globosum, and Penicillium roquefortii the respective exposures in days for LD99 were 21, 4, 9, and 2; and the percentages of visible mutation were 1.0, 6.1, 10.1 and 3.5. The must numerous mutants obtained have been those having reduced growth or reproductive rates. The amount of radiation associated with the cells in this method approximates dosages of x rays similarly affecting fungi as one μc of polonium produces 326 rep per day. (auth)

1086

Brookhaven National Lab.

THE MECHANISM OF GENETIC EFFECT OF P^{32} IN BACTERIA; by B. A. Rubin. [nd] 13p. (BNL-1069)

The biological effect of absorbed unstable isotopes is related, in some cases, to the chemical changes resulting from radioactive decay rather than to the accompanying radiations. The special geometric and metabolic characteristics of bacterial cultures are employed to show that genetic effects of P^{32} may be attributable to the rupture of the phosphate bond in desoxyribose nucleic acid. Other examples illustrate the use of the nuclear disintegration technique as an indicator of the specific chemical changes which can produce biological and genetic effects. Possible evolutionary significances are discussed. (auth)

1087

ACNE AND GYNECOMASTIA FOLLOWING I^{131} THERAPY FOR HYPERTHYROIDISM. F. K. Bauer and W. E. Goodwin. J. Clin. Endocrin. 11, 1574-6(1951) Dec.

Symptoms of acne and gynecomastia occurrences after I^{131} therapy are described and the physiological factors causing these occurrences are discussed.

1088

THE UPTAKE OF TRITIUM-LABELLED WATER VAPOUR BY THE MAMMALIAN LUNG. I. G. Campbell, D. F. White, and P. R. Payne. Brit. J. Radiology 24, 682-84(1951) Dec.

The rate of uptake of tritiated water vapor by the lung of the mouse has been measured; 86 to 100% of inspired THO molecules have been found to pass into the body water. The relationship between these figures and a tolerance concentration of THO in laboratory air is discussed. (auth)

1089

LOBAR DEPOSITION AND RETENTION OF INHALED INSOLUBLE PARTICULATES. H. E. Stokinger, L. T. Steadman, H. B. Wilson, G. E. Sylvester, S. Dziuba and C. W. LaBelle. Arch. Ind. Hyg. Occupational Med. 4, 346-53(1951) Oct.

The rates of alveolar deposition and elimination of insoluble particulates were determined for each of the lobes of the rat lung following inhalation of uranium oxides of different mass-median particle sizes.

1090
SOME EFFECTS OF X-IRRADIATION ON TURTLES. Paul D. Altland, Benjamin Highman, and Betty Wood. J. Exptl. Zool. 118, 4-14(1951) Oct.

Box turtles were given whole-body x irradiation with doses ranging from 500 to 10,000 r. In general the effects of x irradiation on turtles appeared to be similar to those on mammals, but they occurred at a much slower rate. Turtles survived for 270 days (alive at writing) with doses of 500 r; 4 of 6 survived longer than 4 months after 1000 r; 2 of 6 turtles receiving 1500 r survived 4 months; higher doses up to 10,000 r caused death in from 18 to 48 days. The carapace and plastron reduced the tissue dose by approximately 10%. Effects on circulatory and general systems are noted.

1091
FURTHER STUDIES ON THE RADIOSENSITIVITY OF THE ANALOGOUS MOUSE MAMMARY TUMORS dbrB and C3H. Anna Goldfeder. Radiology 47, 845-63(1951) Dec.

The growth rates of mammary adenocarcinomas of mice were studied before and after irradiation. Chalkley's method (J. Nat. Cancer Inst. 4, 47-53(1943-44)) was applied for quantitative evaluation of growth activity of the tumors, taking the mitotic index as the criterion. A depression in mitotic activity in the irradiated tumors was noted, the extent of which depended upon the dose of radiation applied and the lapse of time between exposure and removal of the tumors for analysis. An earlier and more pronounced return of mitotic activity was noted in the faster-growing dbrB type tumors following sublethal doses of radiation, as compared with the slower-growing C3H type. The levels of the phosphorylated intermediates in the glycolytic cycle for the two mouse mammary adenocarcinomas were determined. The more rapidly growing mammary tumor (dbrB) shows significantly higher levels of glucose-1-phosphate, adenosine triphosphate, and possibly glycogen, and a lower level of inorganic phosphorus than the slower-growing C3H tumor. These findings strongly suggest that a higher level of energy is available for vital function in the dbrB tumor. Some of the compounds encountered in the phosphorylated glycolytic cycle, particularly adenosine triphosphate, may be more readily affected by irradiation in the C3H tumor than in the dbrB tumor. The metabolic processes were operative even after such large doses as 30,000 r for the dbrB tumor and 12,000 r for the C3H, although these doses proved to be lethal for their respective growth activities. Successful application in radiotherapy and advantages of applying large doses of x rays through small portals exposing only the tumor is discussed.

RADIATION HAZARDS AND PROTECTION

1092
Oak Ridge National Lab.
EVALUATION OF A COTTRELL ELECTROSTATIC PRECIPITATOR ON A RADIOCHEMICAL PROCESS OFF-GAS SYSTEM, by J. C. Suddath. Issued Nov. 26, 1951. Decl. without deletions Jan. 14, 1952. 39p. (AECD-3295; ORNL-1082)

A Cottrell Electrostatic Precipitator, installed on an off-gas system of the ORNL iodine recovery operation and the ORNL special isotope recovery operation, was evaluated to determine its radioactivity-removal efficiency. The sampling of the gas contaminated with radioactivity was studied and a satisfactory technique developed.

1093
Oak Ridge National Lab.
THE EFFECT OF ACETYL-β-METHYLCHOLINE, CARBAMYLCHOLINE, AND ATROPINE ON THE SURVIVAL OF X-IRRADIATED MICE (abstract); by W. T. Burnett, Jr., A. W. Burke, Jr., and A. C. Upton. [nd] 1p. (AECU-1793)

The ability of certain drugs which act on the autonomic effector cells to modify the effects of x radiation in mice of the C_{57} black strain has been examined. The 28-day LD_{50} of x rays for 8- to 10-week-old male mice of this strain is approximately 600 r. The LD_{50} after treatment with acetyl-β methylcholine bromide (mecholyl bromide, 17-135 mg per kilo body weight), acetyl-β-methylcholine chloride (mecholyl chloride, 36 mg per kilo), or carbamylcholine chloride (Doryl, 1 mg per kilo), was approximately 900 r. The protective effect was observed when the drugs were given by intraperitoneal injection 3 to 5 min before total-body x irradiation. A similar pretreatment with betaine (500 mg per kilo), sodium bromide (14 mg per kilo), sodium chloride (0.2 ml of physiological saline), or atropine sulfate (2 mg per kilo, intramuscularly) failed to alter the survival pattern. However atropine, given before irradiation, counteracted the protective action of mecholyl bromide. Gross anatomical findings in mice sacrificed at intervals following x irradiation indicate the development of acute radiation injury qualitatively similar in both mecholyl-treated and nontreated animals. The damage in the treated group however appeared less severe and recovery occurred much earlier. However, mice that survived 56 days or longer after exposure showed testicular atrophy, depigmentation of fur, and retarded growth indicating that regeneration was not complete. The mechanism of the protective action of the parasympathomimetic drugs remains to be established. Available data suggest that it involves the production of hypoxia, although the possibility of a specific pharmacologic or homeostatic effect must be considered. (Entire report. Abstract of paper for N.Y. meeting of the Am. Soc. for Pharmacology and Exptl. Therapeutics (Fed. Am. Soc. Exptl. Biol.), Apr. 14-18, 1952.)

1094
Oak Ridge National Lab.
PROTECTION OF α-CHYMOTRYPSIN AGAINST GAMMA RADIATION (abstract); by David G. Doherty. [nd] 1p. (AECU-1794)

Electrophoretically homogeneous α-chymotrypsin was prepared from bovine pancreas by the usual procedures, lyophillized, and utilized for all the radiation experiments. Enzymatic activity was determined by following the rate of hydrolysis of glycyl-L-tyrosine amide with a potentiometric formol titration. Dilute chymotrypsin solutions were exposed to γ-ray dosages from 1000 to 120,000 r from a cobalt source at the rate of 140 r/min; maximum inactivation of 30% was obtained at the 40,000-r level. Dry chymotrypsin irradiated at dosages from 500,000 to 10,000,000 r gave essentially similar results although shifted to a higher dosage level. The Km remained unchanged from all the irradiated enzyme, indicating that there had been no alteration in the active centers of the enzyme molecule. This was substantiated by binding studies with a radioactive tagged substrate by the procedure of Doherty and Vaslow (J. Am. Chem. Soc., (1952) Jan.). Since substrates protect enzymes against radiation damage it might be expected that competitive inhibitors would show the same effect. Adjustment of concentrations might yield conditions which would give protection but very little inhibition. Thus chymotrypsin was irradiated with 20,000 r in the presence of several inhibitors, i.e., acetyl-L-tyrosine, 4-p-hydroxyphenyl-3-acetaminobutanone-2, p-hydroxyphenyllactic acid, and phenyllactic acid. Inhibition varied from 2 to 50% while, with the exception of phenyllactic acid, which gave 50% protection,

the other inhibitors afforded complete protection to the enzyme. Different inhibitors are being investigated in an effort to gain some insight into the structural part of the enzyme damaged by radiation. (Entire report)

1095

Oak Ridge National Lab.

STANDARDS OF RADIOLOGICAL PROTECTION AND CONTROL, p.176-209 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Karl Z. Morgan. Dec. 1951. (TID-5031(p.176-209))

The standards of radiological protection and control are discussed. The generally accepted levels of maximum permissible exposure (MPE) to ionizing radiation and the maximum permissible concentration (MPC) of radioisotopes in our bodies are given. Tables are given which show the effect on the human body of different dosages and kinds of radiation. Values of MPE and MPC for use during periods of extreme emergencies are suggested. A method of spotting and charting badly contaminated areas following an atomic disaster is briefly discussed.

1096

THE HAZARD OF RADIATION. Albert E. Heustis and Donald Van Farowe. Radiology 57, 832-6(1951) Dec.

The Division of Industrial Health of the Michigan Department of Health made a study of the operation of fluoroscopic and x-ray installations in the eleven state mental hospitals, in an effort to determine whether personnel were being subjected to hazardous amounts of radiation. The results of the investigation are tabulated and 14 factors to be considered in eliminating such hazards in hospitals are given.

RADIATION SICKNESS

1097

Naval Medical Research Inst., Bethesda

NEWER CONCEPTS OF RADIATION SICKNESS AND ITS TREATMENT; by F. Ellinger. May 23, 1951. 18p. (NP-3566; Lecture and review series No. 51-6; R5826)

A review is presented of the symptomatology, pathology, and treatment of radiation sickness.

RADIOGRAPHY

1098

STANDARDIZATION IN RADIOLOGY. H. Graf. Fortschr. Gebiete Röntgenstrahlen 75, 740-4(1951) Dec. (In German)

The history of standardization in radiology is reviewed and its necessity is emphasized. Six committees and their special tasks in furthering of radiology standardization are enumerated.

1099

THICKNESS OF SECTION IN TOMOGRAPHY. J. Duhamel. J. radiol. électrol. 32, 758-62(1951). (In French)

Using optical geometry, a method is found for calculating the thickness of layers taken in tomographic photography, thus giving an indication of the degree of enlargement of the particular section and size of the area taken.

1100

DOSAGES RECEIVED BY PATIENTS DURING X RAY DIAGNOSTIC EXAMINATIONS. F. Wachsmann. Fortschr. Gebiete Röntgenstrahlen 75, 728-33(1951) Dec. (In German)

The dosages received by patients during routine x-ray examinations were measured; the values found agree with those known from earlier investigations by other authors. Even with modern radiographic techniques the dosages given are sometimes considerable. Thickening of the filter was found to be a possible means of dosage reduction. A nomograph is given with the aid of which dosage determinations can be made easily and quickly. (auth)

1101

NOTE ON THE CYTOCHEMICAL ANALYSIS OF ELEMENTS BY ROENTGEN RAYS. Arne Engström. Acta Radiol. 36, 393-6(1951) Nov.

Analysis of elements by x-ray-absorption measurements cannot be performed on biological samples thinner than 0.1 μ. It is shown how dry weight (mass) per unit area can, however, be determined in such samples. C, O, and N can be determined in samples 1 μ thick; P and S may be determined, in addition, in samples of 10 to 20 μ thickness.

RADIOTHERAPY

1102

1,000-CURIE COBALT-60 UNITS FOR RADIATION THERAPY. H. E. Johns, L. M. Bates, E. R. Epp, D. V. Cormack, S. O. Fedoruk, A. Morrison, W. R. Dixon, and C. Garrett. Nature 168, 1035-6(1951) Dec. 15.

With the high neutron-flux density of the Canadian nuclear reactor at Chalk River, sources of Co^{60} having specific activities of 20 to 60 c/g can be prepared. One gram of this isotope will give about the same radiation output as 32 to 96 g of Ra. The γ rays from Co^{60} have energies of 1.17 and 1.33 Mev; thus the average energy is about the same as that of the γ rays from a sealed Ra source. Descriptions are given of two different units designed for use of the Co^{60} sources in radiation therapy and installed in Canadian hospitals. Depth-dose measurements made using d-c amplifiers with small ionization chambers and water phantoms are tabulated and compared with x-ray measurements. The percentage depth-doses for the Co rays are considerably higher than for 2-Mev x rays and slightly higher than for 3-Mev radiation.

1103

THE USE OF RADIOACTIVE COBALT IN NON-RESECTABLE HEAD AND NECK CANCER. Arthur G. James, Roger D. Williams, and Joseph L. Morton. Cancer 4, 1333-6(1951) Nov.

This is a preliminary report of the use of radioactive cobalt in nonresectable head and neck cancer. Clinical reports are presented describing the use of Co^{60} in specific cases. The qualities of Co^{60} are discussed. The following advantages result from these qualities: 1. Co^{60} may be implanted in an irregular volume of tumor tissue providing uniform and adequate irradiation; this is chiefly possible because of the flexible nylon applicators used. 2. It may be employed more safely near bone or near previously irradiated tissue than radium. 3. It may be kept readily on hand, so that it may be implanted in nonresectable malignant tumors unexpectedly encountered at the time of primary surgery. (auth)

1104

CHANGES IN BLOOD IODINE FRACTIONS AND RADIOACTIVITY UNDER THERAPY. William T. Salter, Michel de Visscher, George B. McAdams, and Ira Rosenblum. J. Clin. Endocrinol. 11, 1512-23(1951) Dec.

If overwhelming doses of I^{131} are avoided, the functional status of the human thyroid gland is not appreciably altered during the first week after conservative therapeutic dosage with the isotope. The thyroid clearance is the same as found for glands not treated with radioactive iodide; and the thyroxine metabolic turnover rate is the same as with test doses. Consequently, test doses of I^{131} afford a reliable preview of the fate of conservative therapeutic doses over a wide range of thyroid activity.

1105

TREATMENT OF UTERINE CANCER WITH RADIOACTIVE COBALT (Co^{60}). Carl-Erik Johanson, Gustaf Östling, and R. V. Gåsström. Acta Radiol. 36, 324-7(1951) October.

The authors point out the advantages of radioactive cobalt as a source of γ-radiation in the treatment of carcinoma of the uterus. Its ease of application and particularly its price contrast favorably with radium. (auth)

1106
A STUDY OF THE USE OF RADIOACTIVE GALLIUM IN MEDICINE. Frederick R. Lang. Ann. Internal Med. 35, 1237-49(1951) Dec.

Use of radioactive Ga in the diagnosis and therapy of primary or metastatic malignancy of the bone is discussed. The toxicity, metabolism, chemistry, and availability of Ga is reviewed. Included are case histories of six patients (having various types of bone malignancies) to whom Ga^{72} was administered.

1107
RADIOCOBALT IN THE FORM OF PLASTIC PREPARATIONS FOR USE IN RADIOTHERAPY. Josef Becker and Kurt Ernst Scheer. Radiotherapy 85, 581-88(1951). (In German)

Co^{60} in the form of fine metal dust was worked into a plastic mass consisting of chicle and commercial polymers. Definitely measured quantities can be molded to shape for application inside or on the surface of the body.

TOXICOLOGY STUDIES

1108
Oak Ridge National Lab.
EFFECTS OF NITROGEN MUSTARD ON CELL DIVISION IN PARAMECIUM (abstract); by R. P. Geckler and R. F. Kimball. [nd] 1p. (AECU-1802)

The mutagenic compound methyl bis (ββ′-dichloroethyl)-amine, nitrogen mustard, is effective in delaying cell division in stock 90, variety 1 of Paramecium aurelia and in an unidentified stock of P. caudatum. Ten-minute exposures were made to concentrations ranging from 0.05 ml to 3.0 mg/ml in phosphate buffer at pH 6. In both species, the first division after exposure was most greatly delayed, but the first four to six division intervals were longer than normal in most lines of descent. There were indications that the third interval was slightly longer than the second. The mustard-treated material resembles more nearly x-irradiated material, in which the first interval is likewise the longest, than ultraviolet-irradiated material in which the third and fourth intervals are the longest. In P. caudatum exposed to concentrations of 1.5 mg/ml, the period to the first division averaged 27 hr as against 6.5 hr for the controls, a delay of approximately three division intervals. P. aurelia exposed to the same concentration divided, on the average, 9 hr after exposure, while the controls divided after ~4.5 hr, a delay of about one fission interval. In both species, the total effect was only slightly dependent on concentration, suggesting that the quantity of nitrogen mustard which can penetrate the cell in 10 min is limited or that the maximum effect is reached at low dosages. (Entire report)

1109
CURRENT CONCEPTS OF BERYLLIUM POISONING. H. S. Van Ordstrand. Ann. Internal Med. 35, 1203-17(1951) Dec.

A summary is presented of research work on Be poisoning being carried out in various parts of this country and elsewhere. 23 references.

TRACER APPLICATIONS

1110
Oak Ridge National Lab.
POTASSIUM EXCHANGE IN RAT TISSUES (abstract); by J. Ginsburg. Oak Ridge National Lab. and Tulane Univ. [nd] 1p. (AECU-1797)

Intravenous K^{42} disappears rapidly from the plasma of Sprague-Dawley male rats in about 4 exponential stages. The first or vascular stage is very rapid, 95% of the injected tag disappearing in 1.5 min. The slower second and third stages ending at 10 and 45 min are respectively related to uptake by kidney, heart, and lung and to uptake by the liver, spleen, and intestine. At the beginning of the fourth stage (30 to 40 min.) all visceral organs are equilibrated. This latter stage represents uptake by muscle, testes, brain, etc. Muscle K^*/K equals plasma at 7 hr. Unlike the report of Walker and Wilde for the rabbit (Am. J. Physiol. 159, 594(1949); 163, 759(1950)), plasma K^*/K does not rise again secondarily as if by backflow of tag from the liver. Nor does liver K^*/K, after first reaching plasma K^*/K, then continue to rise while plasma K^*/K is yet falling. Kidney K^*/K, equal to plasma at 2 min, continues to climb to a peak about 4 times the concurrent K^*/K of plasma at 5 min, then declines rapidly to equilibrate with plasma at 30 min. All the tissues analyzed contain 81% of body K, and at 7 hr they contain 85% of the dose. The bearing of this on the calculation of total-body K by isotope dilution is discussed. (Entire report)

1111
Oak Ridge National Lab.
TRANSCAPILLARY MOVEMENT OF AN ISOTOPE FROM A NONUNIFORMLY MIXED CIRCULATORY POOL (abstract); by C. W. Sheppard and Ward Sangren. [nd] 1p. (AECU-1798)

We have investigated the data of Walker and Wilde (Am. J. Physiol. 163, 759(1950)) on the disappearance of K^{42} from the circulation of the rabbit. Here the circulatory level of isotope changes so rapidly that no semblance of a uniformly mixed pool exists. Our analysis applies where a large fraction but not all of the isotope is removed on one circulatory passage. It is also confined to the case of a large extravascular pool and to events early in time where minimal return flow of tracer occurs. In the case of observations on the inflow to and outflow from a capillary bed, using semilog plots of concentrations, events upstream are repeated downstream but displaced in time by the mean circulation time between the points of observation. Downward displacement occurs by the product of the circulation time and the mean exchange rate between the points. Smearing occurs as a result of the dispersing action of variable path lengths in the capillary bed. For the circulation as a whole the time relations consist of the sum of a periodic (circulatory mixing) component and an aperiodic component. The latter is initially nearly straight on semilog coordinates and extrapolates back to the blood-volume dilution when injection and sampling points are close together. When they are separated correction must be made for time delay and loss of tracer between. The initial slope gives the over-all mean exchange rate. (Entire report)

1112
Sloan-Kettering Inst. for Cancer Research
THE INCORPORATION OF EXOGENOUS PURINES INTO THE PENTOSE NUCLEIC ACID BY LACTOBACILLUS CASEI; by M. Earl Balis, Daniel H. Levin, George Bosworth Brown, Gertrude B. Elion, Henry Vanderwerff, and George H. Hitchings. Sloan-Kettering Institute for Cancer Research and Wellcome Research Labs. [nd] 31p. (AECU-1814)

A purine anabolism pattern for Lactobacillus casei was obtained from numerous experiments with C^{14}-labeled adenine, guanine, 2,6-diaminopurine, and formic acid, in the presence and absence of folic acid. The metabolic tracer experiments described demonstrate the utilization of diaminopurine to an extent far beyond expectations and yield data which give some insight into the mechanism of the inhibitory action of diaminopurine.

1113
Sloan-Kettering Inst. for Cancer Research
THE ZONE OF LOCALIZATION OF ANTIBODIES; XIV. ANTI-RAT-AORTA ANTIBODIES; by David Pressman, Beila Sherman, and Leonhard Korngold. [nd] 25p. (AECU-1827)

Antisera to rat aorta were prepared in rabbits. The globulin fractions of the sera were iodinated with I^{131} and the in vivo localization properties were studied by determining the localization of the radioactivity in the various rat organs and aorta. The anti-aorta antibodies localized in liver, lung and kidney as well as in aorta. The antibodies were purified by eluting them from the various organs in which they had localized. The fractions eluted from liver, kidney and lung returned preferentially to the organ from which they had been eluted. From this we conclude that the anti-aorta serum contained a mixture of localizing antibodies with individual specificities. (auth)

1114
Brookhaven National Lab.
THE COPPER METABOLISM OF DROSOPHILA; by D. F. Poulson, V. T. Bowen, R. M. Hilse, and A. C. Rubinson. Brookhaven National Lab. and Yale Univ. [nd] 18p. (BNL-1027)

An abstract of this report was indexed as Report AECU-1646 and appeared in Nuclear Science Abstracts as NSA 5-6623.

1115
Brooknaven National Lab.
FATE AND DISPOSAL OF PLASMA SUBSTITUTES (abstract); by Robert Steele and D. D. Van Slyke. [nd] 1p. (BNL-1041)

Preparations of PVP, uniformly tagged with C^{14}, have been tested by intravenous injection in mice of 1-ml doses of 3.5% solutions in saline-citrate. The distributions of molecular sizes in two of these preparations were determined by fractionation studies carried out by F. R. Eirich for the National Research Council:

Preparation	"K" Value	% of Original Material in Fraction	Average Mol. Wt. of the Fraction
GAF2809-89H	36	16.3	148,000
		31.8	107,000
		37.7	45,000
		14.2	10,000
GAF2809-89L	29	14.7	118,000
		13.0	78,000
		36.5	35,000
		35.8	10,000

For the other sample used (Sch C^{14} PVP-SL; "K" value = 30.1) we have at present no information as to the distribution of molecular sizes.

The GAF samples, tested in two Swiss female mice, and the Sch sample, tested in two C-57 black female mice, give the following data for long-term retention:

Product	"K" Value	Elapsed Time	Per Cent of Injected C^{14} in Pelt	Liver	Spleen	Whole Carcass
GAF2809-89H	36	8 days	21.3	4.4	0.3	40.5
GAF2809-89L	29	8 days	11.1	2.7	0.1	24.5
Sch C^{14}PVP-SL	30.1	58 days	4.3	4.6	0.5	15.3
Sch C^{14}PVP-SL	30.1	58 days	4.4	4.1	0.6	16.3

The routes for excretion were as follows:

Product	"K" Value	Elapsed Time	Per Cent of Injected C^{14} in Urine	Feces	CO_2	All
GAF2809-89H	36	0–1 day	26.2	5.2	0	31.4
		0–8 days	30.2	13.5	0	43.5
GAF2809-89L	29	0–1 day	54.1	5.4	0	59.5
		0–8 days	57.6	13.0	0	70.6
Sch C^{14}PVP-SL	30.1	0–1 day	51.8	6.3	0.12	58.2
		0–8 days	57.2	11.7	0.12	69.0
		0–58 days	59.8	16.1	0.12	76.0
Sch C^{14}PVP-SL	30.1	0–1 day	55.7	5.3	0.13	61.1
		0–8 days	61.8	9.9	0.13	71.8
		0–58 days	63.9	13.0	0.13	77.0

Over-all recoveries of injected C^{14} from excreta and carcasses were from 84 to 95% of the doses. The absence of significant amounts of C^{14} from the respiratory CO_2 indicates that PVP does not enter metabolic channels and encourages the belief that the C^{14} found in the excreta and in the carcasses is in the form of PVP carbon. (Entire report)

1116
Oak Ridge National Lab.
K^{40} MEASUREMENTS IN BODY FLUIDS; by Wm. M. Hurst. Issued Jan. 16, 1952. 8p. (ORNL-1165)

The use of a recently developed instrument to roughly assess the radioactivity in unconcentrated body fluids is discussed, and the details of K^{40} measurements are given.

1117
A SIMPLE PROCEDURE FOR DETERMINATION OF THE APPROXIMATE LYMPH SPACE. R. H. Storey, J. Moshman, and J. Furth. Science 114, 665-7(1951) Dec. 21

Transfer equations between plasma and lymph are formulated and a simplified formula is given to find the lymph volume, assuming that the volumes of blood and lymph remained constant with time and that the metabolism rates in the two compartments were equal. The average rate of disappearance of I^{131}-tagged albumin from blood plasma and equilibration of radioactivity between plasma and lymph is illustrated and the rate of metabolism can be estimated from these curves. The approximate tissue space (volume of lymph) of any part of the body can be estimated without sampling lymph by measuring the quantity of labeled albumin per unit volume of blood plasma after mixing time, and of blood and lymph after equilibration time. After allowance for metabolism, the loss in blood activity during equilibration time is a function of the albumin mass in the lymph. A conversion factor (ratio of albumin concentration in lymph to plasma) multiplied by the loss in plasma activity is proportional to the tissue space. The lowest conversion factor found was 0.5; normal factor in dogs, 0.6. The factor is raised with heightened permeability, the theoretical maximum being unity.

CHEMISTRY

1118
Brookhaven National Lab.
A THEORETICAL EVALUATION OF THE NITROGEN ISOTOPE EFFECT IN THE THERMAL DEAMMONATION OF PHTHALAMIDE; by Jacob Bigeleisen. [nd] 7p. (BNL-1068)

A theoretical analysis is made of the effect of N^{14}–N^{15} isotopic substitution on the rate of deammonation of phthal-

amide which is not restricted to the zero-point energy effects in the possible mechanisms. Good agreement is found between the theory and the experimental results of Stacey, Lindsay, and Bourns (Can. J. Chem., in press).

1119

Ames Lab.

SPECTROPHOTOMETRIC INVESTIGATIONS OF SOME COMPLEXES OF RUTHENIUM II. THE RUTHENIUM–THIOUREA SYSTEM; by Ruth Powers Yaffe and Adolf F. Voigt. Jan. 11, 1952. 16p. (ISC-195)

The ruthenium(IV)-thiourea system has been studied spectrophotometrically. It was found that both Ru(III) and Ru(IV) form the same blue-green complexes, $Ru(SC(NH)NH_2)_1^{++}$ and $Ru(SC(NH)NH_2)_3$. In the reactions thiourea behaves as an acid, liberating a hydrogen ion for each molecule of thiourea which goes into the complex. At an ionic strength of 3.0, the monothiourea complex was found to have a formation constant equal to 16.3 ± 0.5, while the constant for the trithiourea complex was found to equal 5.3 ± 0.1. A method of interpretation of spectrophotometric data was developed which is applicable to two complexes of low stability. (auth)

1120

Texas Agricultural Experiment Station

SYNTHESES OF DERIVATIVES OF DIHYDROXYACETONE AND OF GLYCERIDES (1,2); by Hermann Schlenk, Beverly Lamp, and B. Wallace DeHaas. [nd] 13p. (ORO-56)

A synthesis of glycerides is reported in which the alcoholic groups of the glycerol successively are built up and become available to react with individual fatty acids. Dihydroxyacetone esterified with fatty acids is an intermediate in the procedure. Palmitoxy-hydroxyacetone is found to occur in a monomer and a dimer form. In the further reactions the keto group is catalytically reduced and forms the β-hydroxy group of the glycerol.

1121

THE HEAT OF SOLUTION OF LITHIUM IN AMMONIA AT −33°. Lowell V. Coulter and Louis Monchick. J. Am. Chem. Soc. 73, 5867-8(1951) Dec.

Using the calorimetric procedure previously described (Coulter and Maybury, J. Am. Chem. Soc. 71, 3394(1949)), the authors have remeasured the heat of solution of Li in liquid NH_3. The result, -9.65 ± 0.2 kcal/equiv is in good agreement with the previous value, −9.55 kcal/equiv. The ΔH for the equation $\frac{1}{2}\, e_2^{--}(am) + NH_4^+(am) = NH_3(l) + \frac{1}{2}H_2(g)$ becomes −40.8 kcal/equiv, thereby confirming the earlier conclusion that Li forms a typical alkali-metal solution with NH_3 in the moderately dilute region.

1122

THE DETERMINATION OF THE ISOTOPE EFFECT AND ITS VARIATION WITH TEMPERATURE IN THE DEHYDRATION OF FORMIC-C^{14} ACID. Gus A. Ropp, A. J. Weinberger, and O. Kenton Neville. J. Am. Chem. Soc. 73, 5573-5(1951) Dec.

An isotope effect of $11.11 \pm 0.52\%$ at 0°C and of $8.59 \pm 0.58\%$ at 24.75°C has been measured in the dehydration of formic-C^{14} acid in sulfuric acid. These values, expressed as $100(k_{12} - k_{14})/k_{12}$, correspond to a difference of 189 ± 53 cal/mole between the Arrhenius activation energies for the reaction of formic-C^{12} acid and formic-C^{14} acid. A sensitive flow method of measurement has been developed, which is applicable in the study of first-order reactions yielding a gaseous radioactive product. (auth)

1123

EXCHANGE STUDIES WITH COMPLEX IONS. II. THE KINETICS OF THE EXCHANGE OF RADIOCYANIDE ION WITH POTASSIUM HEXACYANOMANGANATE(III) IN AQUEOUS SOLUTION. Arthur W. Adamson, Joan P. Welker, and W. B. Wright. J. Am. Chem. Soc. 73, 4786-90(1951).

The results of a kinetic study of the exchange in aqueous solution between potassium hexacyanomanganate(III) and potassium radiocyanide are reported. The exchange rate is found to be first order in complex ion concentration, and to be independent of the cyanide concentration, of pH over the range 9.0 to 10.8, and of ionic strength. It is not photocatalyzed but is slightly dependent upon extent of glass surface. The first order rate constant at 0° is 2.64×10^{-2} min^{-1} and the activation energy is found to be ~8.5 kcal/mole. It is proposed that the rate-determining step involves the heptacoordinated ion $Mn(CN)_6H_2O^{-3}$. The general applicability of a mechanism of this type to the exchange results reported for various tetra and hexa-coördinated cyanides is discussed. (auth)

1124

THE CHEMISTRY OF THE ISOTOPES OF OXYGEN. Malcolm Dole. Rev. brasil. quím. 32, 124-31(1951) Aug. (Paper presented at the fifth South American Congress of Chemistry in Lima, Peru.) (In Spanish)

The isotopes of oxygen are discussed with regard to relative abundances in air and in O_2 produced by photosynthesis, nuclear reactions necessary to form them, separation procedures, half lives, radiations, and masses. Chemical applications briefly considered and illustrated by specific examples are direct analysis of organic compounds of O_2 by the method of isotopic dilution, tracer applications, studies of isotope exchange, and equilibrium studies in reactions involving isotope exchange. 9 tables.

1125

THE LOWER OXIDATION STATES OF ALUMINUM. George W. Watt, James L. Hall, and Gregory R. Choppin. J. Am. Chem. Soc. 73, 5920-1(1951) Dec.

A preliminary report is made on conclusive evidence for the existence of +1 and +2 Al oxidation states in solution, based on potentiometric titrations of liquid NH_3 solutions of Al(III) iodide with liquid NH_3 solutions of K. In a typical experiment, 8.31×10^{-4} g-eq wt of pure Al(III) iodide dissolved in ~45 ml of anhydrous liquid NH_3 was titrated with 8.56×10^{-2} M K solution. The titration curve showed two quite distinct end points which correspond to the addition of 3.25 and 6.60 ml of the K solution; the calculated volumes required for reduction of Al^{+3} to Al^{+2} and Al^+ are 3.24 and 6.49 ml, respectively. Following the end point corresponding to completion of reduction to Al^{+2}, a trace of white crystalline solid appears, the potential decreases gradually, then increases until the end point corresponding to Al^+ is reached. A similar trend is observed following reduction to Al^+.

1126

THE STRUCTURE OF THE CARBIDE SYSTEM TiC-TaC-WC. H. Nowatny, R. Kieffer, and O. Knoteck. Berg- u. hüttenmänn. Monatsh. montan. Hochschule Leoben 96, 6-8(1951). (In German)

The following abstract appeared in Metallurgical Abstracts 19, 183(1951) Nov. (J. Inst. Metals 80, (1951) Nov.) and is reproduced here in its entirety.

A microscopic and x-ray study is reported of this system over the compn. range WC 31.4–91.5, TiC 2.0–48.0, and TaC 6.5–76.4 at. %. The specimens were prepared by powder-metallurgy methods, sintering being carried out at 2200 ± 50°C; some of the specimens were then annealed for 1 hr at 1450°C in vacuo or in H; others were ground, sieved, mixed with ~8% Co to act as a binder, extruded through graphite dies at 1500°C and 150 kg/cm² pressure, and then annealed for 40 hr. Equilibrium diagrams show the phase fields existing at 1450 and 2200°C, viz., an ex-

tensive field of homogeneous (Ti, Ta, W)C solid soln. and a heterogeneous region consisting of this solid soln. and practically pure WC. The homogeneous region becomes more extensive with increase in temp., i.e., increase in solubility of WC in the continuous solid-soln. system TiC–TaC, until at 2200°C ~30 mole % WC is in soln. Specimens which had been annealed at 1450°C showed: (1) less porosity than those which had been freshly sintered, (2) a coarse crystal formation, and (3) the presence of small amounts of a third phase—of a blue color, and brittle—at the grain boundaries; this is probably a Co-contg. phase or a double carbide.

1127

THERMAL PROPERTIES OF THE ALKALI METALS. II. THE HEATS OF FORMATION OF SOME SODIUM-POTASSIUM ALLOYS AT 25°. Eugene E. Ketchen and W. E. Wallace. J. Am. Chem. Soc. 73, 5812-14(1951) Dec.

The heats of formation of several Na-K alloys are presented. These data are based upon the measured heats of reaction of the alloys and the two pure metals with water. Heat effects are reported for the alloying of the solid metals and the undercooled liquids. The latter data are compared with results to be expected from Hildebrand's theory of regular solutions and the quasi-chemical theory. Substantial disagreement between experiment and both theories is evident. The disagreement can be explained qualitatively by assuming the exothermal formation of the previously observed intermetallic compound Na_2K. (auth)

1128

ORGANIC TITANIUM COMPOUND. III. THE ELECTRIC MOMENTS OF TETRAETHOXYTITANIUM, MONOCHLOROTRIETHOXYTITANIUM, TETRAPROPOXYTITANIUM, TETRABUTOXYTITANIUM, AND ETHYL ORTHOFORMATE IN HEXANE SOLUTION. C. N. Caughlan, Walter Katz, and William Hodgson. J. Am. Chem. Soc. 73, 5654-5(1951) Dec.

Measurements show electric dipole moments of 1.50, 1.20, 1.15 for $Ti(OEt)_4$, $Ti(OPr)_4$, $Ti(OBu)_4$; 2.51 for $TiCl(OC_2H_5)_3$; and 0.76 for $HC(OC_2H_5)_3$. Both restriction of rotation and an incorrect oxygen valence angle probably account for the difference in experimental and theoretical moment for $Ti(OR)_4$. An estimation of Ti-Cl bond moment is 4.3 based upon Ti-O bond moment of 1.6 D. (auth)

1129

ORGANIC COMPOUNDS OF TITANIUM. II. ASSOCIATION OF ORGANIC TITANATES IN BENZENE SOLUTION. C. N. Caughlan, H. S. Smith, Walter Katz, Wm. Hodgson, and R. W. Crowe. J. Am. Chem. Soc. 73, 5652-4(1951) Dec.

Molecular weight determinations of ethyl, propyl, and butyl titanates and monochlorotriethoxytitanium indicate association numbers in dilute benzene solutions to about three. This association is attributed to the fact that the coördination number of Ti is 6, thus allowing additional oxygens to surround the central Ti. (auth)

1130

THORIUM COMPLEXES WITH CHLORIDE, FLUORIDE, NITRATE, PHOSPHATE, AND SULFATE. E. L. Zebroski, H. W. Alter, and F. K. Heumann. J. Am. Chem. Soc. 73, 5646-50(1951) Dec.

The dependence of the Th extraction equilibrium on the fourth power of TTA activity and the minus fourth power of hydrogen ion activity was demonstrated, confirming that Th(IV) is a simple (hydrated) tetrapositive ion in perchlorate solutions of acidity greater than about 0.08M. The association constants for the first several complexes of thorium ion with fluoride, chloride, nitrate, sulfate, and phosphate ions, respectively, have been determined in acid media by the TTA distribution method. Evidence was obtained that complexes like $Th(H_2PO_4)^{+++}$, $Th(H_2PO_4)_2^{++}$, and $Th(SO_4)_2$ are measurably weak acids in 1 to 2 molar acid solutions. (auth)

1131

THE HEATS OF COMBUSTION OF MAGNESIUM AND ALUMINUM. Charles E. Holley, Jr. and Elmer J. Huber, Jr. J. Am. Chem. Soc. 73, 5577-9(1951) Dec.

Precise measurements of the heats of combustion of Mg and Al have been made. The results are: for Mg, heat of combustion in 25 atm oxygen = 5895.6 ± 4.8 cal/g; heat of formation of MgO, $\Delta H_{25°} = -143.70 \pm 0.12$ kcal/mole; for Al, heat of combustion in 25 atm oxygen = 7403.4 ± 5.7 cal/g; heat of formation of Al_2O_3, $\Delta H_{25°} = -400.29 \pm 0.31$ kcal/mole. A comparison of these results with those of other investigators is made. (auth)

1132

THERMAL PROPERTIES OF THE ALKALI METALS. I. THE HEATS OF REACTION OF SODIUM AND POTASSIUM WITH WATER AT 25°. Eugene E. Ketchen and W. E. Wallace. J. Am. Chem. Soc. 73, 5810-12(1951) Dec.

The heats of reaction of K and Na with an infinite quantity of water at 25° were measured and found to be −47,190 ± 80 and −44,350 ± 70 cal/g-atom, respectively. These results are in reasonably good agreement with other recent determinations except for Roth and Kaule's work (Z. anorg. Chem. 253, 352(1947)) on the Na-water reaction. (auth)

1133

IODIDES OF LOWER VALENT ALUMINUM. Walter C. Schumb and Howard H. Rogers. J. Am. Chem. Soc. 73, 5806-8(1951) Dec.

By the use of an electrodeless discharge at low pressures produced in the vapor of pure aluminum(III) iodide at a temperature not exceeding 50°C, and condensing the iodine formed by means of a dry ice trap, a solid was obtained from the walls of the discharge tube. Exhaustive extraction with anhydrous benzene, followed by vacuum drying, yielded a buff-colored solid, the chemical analysis and the powder x-ray-diffraction data of which are consistent with a mixture of metallic aluminum and a monoiodide, $(AlI)_n$. Freedom from free iodine or unchanged AlI_3 was assured by the absence of any volatile products when heated in vacuo for two hours at 200°C. The existence of halides of lower valent aluminum, which had previously been strongly indicated by experiments with aluminum halides in the gas phase or in solution, is therefore corroborated by the isolation of solid products showing empirical compositions such as $Al_{1.22}I$. (auth)

ANALYTICAL PROCEDURES

1134

Oak Ridge National Lab.

FIREFLY LUMINESCENCE IN THE STUDY OF BIOLOGICAL ENERGY TRANSFER SYSTEMS (abstract); by B. L. Strehler and J. R. Totter, Oak Ridge National Lab. and University of Arkansas. [nd] 1p. (AECU-1792)

It has been shown previously by McElroy and co-workers that extracts of firefly lanterns will luminesce when a divalent ion, "luciferin," oxygen, and ATP are present. Theoretically any of these factors might be made rate limiting and assayed over a range of concentration by measuring the light output of the system. Since highly sensitive light-measuring apparatus is available and since the response of the luminescent system is linear over a wide range of ATP concentrations, we have developed methods for assaying minute quantities of ATP, other phosphorylated compounds, and certain enzymes. For routine measurements the commercially available Farrand photofluorometer has been used to determine ATP concentrations as low as 1 μg/ml while a thousandfold increase

in sensitivity has been made possible through the use of a more highly refined "quantum counter." The following substrates have been assayed by this method: ATP, ADP (pretreatment with myokinase), phosphocreatine (pretreatment with creatine-adenylic transphosphorylase plus adenylic acid), glucose (measuring luminescence in the presence of hexokinase and ATP). Conversely, the enzymes mediating these transformations as well as apyrases have been determined. Changes in ATP concentration in rabbit-liver homogenates mixed with firefly enzyme and the proper substrates have been determined as well as some preliminary measurements of the influence of light on ATP levels in illuminated plants. Advantages of the method include sensitivity and accuracy; limitations include instability at low buffer concentrations and inhibition by monovalent anions. (Entire report. Abstract of paper for N. Y. Meeting of Am. Soc. of Biological Chemists (Fed. Am. Soc. Exptl. Biol.), Apr. 14-18, 1952.)

1135

Argonne National Lab.

APPARATUS FOR THE CONTINUOUS RESOLUTION OF MIXTURES BY ELECTROMIGRATION PLUS CHROMATOGRAPHY (CONTINUOUS ELECTROCHROMATOGRAPHY); by Takuya R. Sato, William P. Norris, and Harold H. Strain. Nov. 1951. 30p. (ANL-4724)

Large cells for the continuous resolution of mixtures by electromigration plus chromatography have now been constructed, and mechanical devices for the support of these cells have also been built. These large electrochromatographic cells have been utilized for the continuous resolution of mixtures of various ions such as calcium and phosphate and silver and chromate. The course of the separation has been followed by the use of radioactive tracers and by the use of reagents that form colored products with the separated ions. Ions with charges of opposite sign are separated rapidly and completely (100%). Specifications for the construction of the electrochromatographic cells, for their supports, and for the electronic voltage rectifier with large adjustable direct current output are presented. The principles involved in chemical precipitation, in chromatography, and in electrochromatography are discussed. Separatory methods based upon these principles supplement each other and provide widely applicable analytical tools. The nomenclature in this field of electrochromatographic separations has been reexamined. (auth)

1136

Geological Survey

FLUORIMETRIC DETERMINATION OF URANIUM IN SHALES, LIGNITES, AND MONAZITES AFTER ALKALI CARBONATE SEPARATION; by Norma S. Guttag and F. S. Grimaldi. Oct. 1951. 18p. (TEI-153-A)

Comparative data are presented on separations of microgram amounts of U from milligram amounts of various metal ions with Na_2CO_3-K_2CO_3, Na_2CO_3-K_2CO_3-H_2O_2, and Na_2CO_3-NaClO. The Na_2CO_3-K_2CO_3 separation procedure is applied to the analysis of shales, lignites, and monazites. This method will determine as little as 0.001% U in shales and lignites and 0.01% U in monazites. Several fluorimetric procedures, based essentially on two techniques, have been developed in the Geological Survey and are used for the analysis of U in a wide variety of material.

1137

North American Aviation, Inc.

DETERMINATION OF OXYGEN IN TIN METAL BY THE AMALGAM METHOD; by L. Silverman. Issued Dec. 21, 1951. 17p. (NAA-SR-164)

In vacuum, Sn metal is completely separated from stannous oxide by Hg. The Sn content of the stannous oxide is then determined colorimetrically by an improved blue phosphomolybdate solution technique; and, from the Sn result, the oxygen is calculated. The procedure is satisfactory for the determination of oxygen concentrations of 0.0001% or less in Sn metal samples weighing 2 to 5 grams. The apparatus developed for the vacuum preparation and treatment of the amalgam is described. (auth)

1138

CONTROLLED POTENTIAL ELECTROLYTIC SEPARATION AND DETERMINATION OF COPPER, BISMUTH, LEAD, AND TIN. James J. Lingane and Stanley L. Jones. Anal. Chem. 23, 1798-1806(1951) Dec.

The optimum conditions for the successive separation and determination of Cu, Bi, Pb, and Sn from a tartrate solution by automatic controlled potential deposition onto a Pt cathode have been established. The influences of such important variables as pH, total tartrate concentration, temperature, and cathode potential have been investigated. All four metals may be determined without any intermediate treatment of the solution, except acidification for the determination of Sn, in a total elapsed time of about 4 hours (1 hour of actual operator time). Very few other elements interfere. The beneficial effect of hydrazine and hydroxylamine as addition agents has been investigated, and their oxidation products at a Pt anode have been identified. Hydrazine in the presence of chloride ion is a much more efficient anodic depolarizer than hydroxylamine, and it plays a more important role by reducing +2 copper to a chloro cuprous complex which greatly accelerates the Cu deposition. (auth)

1139

RAPID PHOTOMETRIC DETERMINATION OF ALUMINUM IN ZINC AND STEEL. Luther C. Ikenberry and Arba Thomas. Anal. Chem. 23, 1806-9(1951) Dec.

It is frequently necessary to determine small amounts (0.002 to 0.10%) of acid-soluble Al in Zn and steel. The conventional gravimetric methods are long and tedious. A simple photometric method has been developed based on the reaction of Al with eriochromecyanin R to form a violet-red colored complex. Its reproducibility is at least equal to that obtained with the gravimetric method. Al may be determined in Zn in 20 min as compared to 4 hr by the gravimetric method. A determination of acid-soluble Al in steel requires only 3 hr as compared to 8 hr by the gravimetric method. (auth)

1140

COLORIMETRIC DETERMINATION OF BORON IN ALUMINUM WITH 1,1-DIANTHRIMIDE. Dwaine A. Brewster. Anal. Chem. 23, 1809-11(1951) Dec.

The determination of B in Al is important in the evaluation of Al conductor materials and experimental wrought Al alloys. A colorimetric procedure was developed that utilizes 1,1-dianthrimide as the color-forming reagent. Accuracy and precision were found to be excellent when tested on several representative aluminum alloys. Results compared favorably with values obtained by the mannite titration procedure and quantitative spectrographic analysis. The method provides a simple, rapid, and accurate procedure that may be used to advantage for the routine determination of B in Al. It may be applied to various Al materials without danger of interferences from major alloying elements. This method offers a distinct advantage over the usual mannite titration procedure, inasmuch as low amounts of B may be determined. B present in amounts from 0.010 to 0.220% has been successfully determined and this range may be extended in either direction by controlling the aliquot that is taken for analysis. (auth)

1141

THERMOGRAVIMETRIC ANALYSIS OF SOME METALLIC 2-METHYL OXINATES. Marcel Borrel and René Pâris. Anal. Chim. Acta 5, 573-83(1951) Dec. (In French)

By thermogravimetric analysis, the authors have determined the composition of some methyl oxinate (2-methyl-8-quinolinol) precipitates; the compounds examined were those of Mg, Cu, Zn, Ni, Co, Tl, V, and Mo. Regions of stability for hydrates and anhydrous compounds were established. The effect of α-methyl substitution on the hydration and stability of the oxine molecule has been demonstrated.

1142

CHEMICAL ANALYSIS BY THE MEASUREMENT OF NUCLEAR MOMENT. (NUCLEAR MOMENTSCOPE ANALYSIS.) Shizuo Fujiwara. Bull. Chem. Soc. Japan 24, 116-17(1951) June.

An apparatus for observing nuclear magnetic resonance has been constructed as an extension of research on high-frequency titrimetry, and its application to qualitative and quantitative analysis has been studied. Results on samples of paraffin-Na_2SiF_6 mixtures are shown. The intensities of energy absorption from the r-f field by the H^1 and F^{19} nuclei are in good correspondence to the percentages of paraffin and Na_2SiF_6 in the sample. The energy absorption line may be easily observed with 0.1 mg of F.

1143

COLORIMETRIC DETERMINATION OF NIOBIUM WITH THIOCYANATE. Harry Freund and Arnold E. Levitt. Anal. Chem. 23, 1813-16(1951) Dec.

The lack of sensitive color reactions has resulted in few satisfactory colorimetric methods for niobium. This paper describes a homogeneous colorimetric method based on the yellow color of a niobium thiocyanate complex. The color system is stabilized by using high concentrations of acid, chloride, thiocyanate, and miscible solvent. The absorbancy of the complex follows the Beer-Lambert law in the concentration range up to 3.5 μg of Nb/ml. Interferences and means of minimizing them are discussed. Application is made to a National Bureau of Standards steel, and procedures are suggested to minimize loss of the niobium prior to its colorimetric estimation. The method described provides a new and sensitive procedure for the determination of small amounts of Nb. (auth)

1144

SPECTROGRAPHIC ANALYSES OF CRACKING CATALYSTS; DETERMINATION OF MAGNESIUM AND ZIRCONIUM. Leon W. Gamble. Anal. Chem. 23, 1817-20(1951) Dec.

The need for rapid methods for determining Mg and Zr in connection with catalyst development problems led to the study of spectrographic procedures. Internal standards, Cu for determination of Mg and Co for determination of Zr, were employed with direct current excitation. The method for Mg has been applied to samples containing from 0.2 to 10.0% magnesia, while the Zr method is useful in the range of 0.01 to 5% Zr oxide. The results obtained by the spectrographic methods are in fair agreement with those obtained by the use of chemical methods. The effect of large amounts of alumina on the determination of Zr is discussed. Both methods are applicable to the analysis of clays. (auth)

1145

SPECTROCHEMICAL ANALYSIS OF LITHIUM. Louis E. Owen and Janus Y. Ellenburg. Anal. Chem. 23, 1823-5 (1951) Dec.

Corrosion studies involving molten Li metal and ferrous alloys made necessary the development of an analytical procedure for the determination of metallic impurities in Li. The general method evolved calls for the spectrographic excitation in a porous cup electrode of the elements of analytical interest separated from the Li matrix. The analytical technique has permitted the quantitative study of corrosion rates not only of Li but also of other alkali metals and alkali metal hydroxides. (auth)

1146

ANALYTICAL CHEMISTRY OF ZIRCONIUM. PART II. CINNAMIC ACID. Ch. Venkateswarlu and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 28, 354-6(1951) June.

Zr is shown to be precipitated quantitatively by cinnamic acid in 0.1N acid, HCl or HNO_3. The metal up to 0.6 mg can be estimated and separated from Th, Mg, U, cerite earths, Be, Al, Ni, and Fe with the reagent. Fe^{+3} alone requires a second precipitation. (auth)

1147

ANALYTICAL CHEMISTRY OF THORIUM. PART VII. SEPARATION FROM CERITE EARTHS. USE OF ANISIC ACID. K. V. S. Krishnamurty and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 28, 261-4(1951) May.

Anisic acid precipitates from neutral or slightly acidic solutions, and, in the presence of ammonium chloride, normal thorium anisate. The presence of a number of elements like Be, Ca, Co, Ni, Mn, Pb, Cu, Al, and rare earths causes no interference. The precipitate on washing may be ignited and weighed as oxide. Thorium in monazite may be estimated in this way. (auth)

1148

THORIUM: ITS DETERMINATION & SEPARATION FROM URANIUM. M. Venkataramaniah, C. Lakshman Rao, and Bh. S. V. Raghava Rao. J. Sci. Ind. Research (India) 10B, 254-5(1951) Oct.

The use of benzoic acid as a reagent for the separation of Th from U is described. Double precipitation is necessary to effect complete separation, and quantities as small as 14 mg of ThO_2 in admixture with 1,400 mg of U_3O_8 can be quantitatively separated. (auth)

1149

SPECTROPHOTOMETRIC CHARACTERISTICS OF DETERMINATION OF TITANIUM WITH THYMOL. John V. Griel and Rex J. Robinson. Anal. Chem. 23, 1871-3(1951) Dec.

Absorption spectra of the thymol-Ti compound are shown, and a spectrophotometric calibration curve is given. The effects of time, temperature, thymol-Ti ratio, and foreign substances are reported.

1150

ANALYTICAL CHEMISTRY OF THORIUM. PART VI. SEPARATION FROM RARE EARTHS. CAMPHORIC ACID. D. S. N. Murty and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 28, 218-20(1951) Apr.

It is shown that camphoric acid precipitates Th quantitatively in an ammonium acetate buffer. The approximate pH has been determined as 4.2 and higher. Cerite earths are precipitated by the reagent at pH 6.2 and higher. Separation of Th from the cerite earths has been achieved by a double precipitation at pH 4.4. The procedure has been utilized for the estimation of Th in monazite extracts. The behavior of a few other elements, Ni, Co, Ti, etc., toward the reagent has also been investigated. (auth)

1151

MICRO H-CELL FOR POLAROGRAPHIC ANALYSIS. Thelma Meites and Louis Meites. Anal. Chem. 23, 1893 (1951) Dec.

A cell is described which can be used for the electrolysis of as little as 0.10 ml of solution, which contains both a built-in saturated calomel reference electrode and a mercury-pool anode which may be used whenever the composition of the solution permits, and in which a solution may be completely deaerated within a few minutes. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1152

North American Aviation, Inc.

MECHANISM FOR SELF-DIFFUSION IN GRAPHITE; by G. J. Dienes. Issued Jan. 7, 1952. 27p. (NAA-SR-159)

The mechanism for self-diffusion in single crystals of graphite has been examined theoretically. Calculations for vacancy and direct interchange mechanisms are based on atomic interactions within the graphite hexagonal layers. These interactions are obtained from the known systematic change of C−C bond strength with interatomic distance. In order to calculate the energy of formation of an interstitial carbon atom, a potential function has been devised to account for interaction between the planes. This potential function consists in two terms, a Van der Waal's attraction and an exponential-type repulsion. The adjustable constants have been evaluated from known physical data. A comparison of the total activation energies for self-diffusion via vacancies, direct interchange and interstitial atoms shows clearly that vacancy diffusion is the preferred mechanism. The activation energy for self-diffusion by means of vacancies is estimated to be 160 kcal/mole with 90 kcal/mole required for the formation and 70 kcal/mole for the motion of a vacancy. The present theoretical treatment is not applicable to diffusion along grain boundaries or pores. (auth)

1153

Carnegie Inst. of Tech.

STATISTICAL THEORY OF PROPERTIES OF SOLID SOLUTIONS; by R. Smoluchowski. July 3, 1951. 30p. (NYO-524)

Properties of binary solid solutions are considered from the point of view of the fluctuation of local composition in the crystalline lattice. These variations influence the properties of the alloys by varying the corresponding local concentration of electrons. A simple general statistical method is given for calculating properties of random and ordered solid solutions. The theory is applied to saturation magnetization, temperature coefficient of electrical resistivity, thermoelectric power, and to other properties in various alloys. A satisfactory agreement with experiment is obtained. (auth)

1154

Carnegie Inst. of Tech.

THE CRYSTALLOGRAPHIC ASPECT OF SLIP IN BODY-CENTERED CUBIC SINGLE CRYSTALS; I. THEORETICAL CONSIDERATIONS; by A. J. Opinsky and R. Smoluchowski. Sept. 1951. 23p. (NYO-525)

The mechanism of slip in body-centered cubic lattices is considered in terms of the relation between the orientation of the tensile axis and the active slip system. A "projection" of points in the unit stereographic triangle on its [001] - [011] side permits an analysis of experimental data and leads to an accurate determination of the ratio of the critical shear stresses on various planes.

1155

Carnegie Inst. of Tech.

THE CRYSTALLOGRAPHIC ASPECT OF SLIP IN BODY-CENTERED CUBIC SINGLE CRYSTALS; II. INTERPRETATION OF EXPERIMENTS; by A. J. Opinsky and R. Smoluchowski. Sept., 1951. 27p. (NYO-526)

A new method for determining the ratios of the critical shear stresses has been applied to data taken from the literature and to original results. Measurements of yield strength were found to be not too satisfactory for the investigation of the slip behavior of the body-centered cubic materials. On the other hand, any method which determined the slip plane and the orientation of the tensile axis gave useful results. In all instances where the data were available, the ratio of the critical shear stresses on (123) and (112) was very close to one, and did not change with temperature. The ratio of the critical shear stresses on (123) and (110) changed with temperature and composition, with the value of S_{123} generally being higher than that for S_{110}. (auth)

1156

METHOD OF PREPARATION OF MONOCRYSTALS. H. Piatier and A. Accary. J. phys. radium 12, 886-7(1951) Nov. (In French)

The apparatus consists of a glass tube containing the solution and inserted vertically in a thermostat. The tube is capped by a mercury joint through which a rod is inserted. Slow rotation of a crystal nucleus attached to the rod has resulted in successful crystal growth of pure stilbene and tolan.

FLUORINE AND FLUORINE COMPOUNDS

1157

RECENT ADVANCES IN ORGANIC FLUORINE CHEMISTRY. R. N. Haszeldine. Nature 168, 1028-31(1951) Dec. 15.

Various topics in synthetic organic fluorine chemistry are discussed, namely, reaction mechanisms of formation of perfluoro esters and lactones by polymerization of tetrafluoroethylene with I followed by reaction with Br or Cl, perfluoro-olefins and perfluoroalkyl Grignard reagents preparation, elimination reactions in decomposition of the Grignard reagent $CF_3(CF_2)_nMgI$ and other elimination reactions of F compounds, and preparation of perfluoroalkyl nitroso and nitro compounds, perfluorocarbinols, Zn and Cd perfluoroalkyls, and perfluoroacids. Infrared wavelengths characteristic of functional groups in F compounds are tabulated. The possibility of synthesizing perfluoroalkyl silicon compounds (fluorosilicones) is discussed.

1158

SOME PHYSICAL PROPERTIES OF HEXADECAFLUOROHEPTANE. George D. Oliver, S. Blumkin, and C. W. Cunningham. J. Am. Chem. Soc. 73, 5722-5(1951) Dec.

The boiling point, melting point, critical constants, density, surface tension, parachor, and infrared and Raman spectra are reported for pure hexadecafluoroheptane. Refractive indices for the sodium D, mercury E and G, and hydrogen C and F lines at 20, 25, and 30°C are given.

1159

THERMODYNAMIC PROPERTIES AND P−V−T RELATIONS OF CHLOROTRIFLUOROETHYLENE. George D. Oliver, J. W. Grisard, and C. W. Cunningham. J. Am. Chem. Soc. 73, 5719-22(1951) Dec. (See also NSA 4-3927)

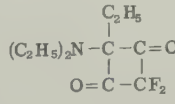
Thermal measurements made on chlorotrifluoroethylene include heat capacity from 16°K to the boiling point, 244.80°K, and a heat of fusion, 1327.1 ± 1.3 cal/mole, at the triple point, 115.00 ± 0.05°K. Vapor pressure measurements which covered the temperature range of −67 to −11°C and pressure range up to two atm are represented by $\log_{10} P_{mm} = 6.90199 - 850.649/(t + 239.91)$. Bubble point pressures from 25°C to the t_c are represented by $\log_{10} P_{mm} \times 7.75412 - 1392.82/(t + 319.70)$. The calculated heat of vaporization is 4965 cal/mole at the boiling point, −28.36 ± 0.05°C. Entropy values calculated for the liquid and ideal gas state at the boiling point are 52.74 ± 0.10 and 73.18 cal/deg/mole, respectively. Pressure−volume−temperature relations were measured at five isotherms between 25°C and the critical point. The experimental critical constants are: t_c, 105.8°; p_c, 40.1 atm; d_c, 0.55 g/ml. (auth)

1160

REACTIONS OF POLYFLUORO OLEFINS. IV. REACTION WITH TRIETHYLAMINE. Karl E. Rapp. J. Am. Chem. Soc. 73, 5901-2(1951) Dec.

When triethylamine was used to catalyze the addition of 1-butanethiol to hexafluorocyclobutene, the product of the reaction was an extremely hygroscopic crystalline solid which reacted readily with water, moist air, or absolute methanol with the evolution of heat and HF. Elemental analysis of the stable hydrolyzed compound and determination of

its molecular weight strongly indicated a molecular composition of $C_{10}H_{15}NO_2F_2$. A possible diketone structure



satisfying both composition and valence requirements might be expected to possess the low water-solubility responsible for the initial precipitation of the compound when the reaction mixture was washed with water. A means by which a structure of this type might be attained would initially involve the formation of a quaternary ammonium fluoride by a F substitution reaction. Analysis of the somewhat impure reactive product agreed fairly well with the composition $C_{10}H_{15}NF_6$.

GRAPHITE

1161

THE INTERLAYER SPACING OF GRAPHITE. G. E. Bacon. Acta Cryst. 4, 558-61(1951) Nov.

From a study of well-crystallized graphites direct evidence is obtained of the different spacings between oriented and disoriented layers, respectively, in a stack of parallel graphite layers. It is shown that when the proportion of disoriented layers is small there is practically a linear relation with the mean interlayer spacing deduced from 0001 lines. (auth)

1162

THE a DIMENSION OF GRAPHITE. G. E. Bacon. Acta Cryst. 4, 561-2(1951) Nov.

The apparent anomalously low values of the a dimension of graphite reported by Bacon (Acta Cryst. 3, 137(1950)) from measurements of the (hki0) lines are explained quantitatively as caused by imperfect crystallinity, the degree of disorder between neighboring layers being such that the intensity of (hki0) reflections in reciprocal space always fall off much less rapidly along the c* axis than perpendicular to it. (auth)

LABORATORIES AND EQUIPMENT

1163

Oak Ridge National Lab.

A HIGH SENSITIVITY RECORDING POLAROGRAPH; by Myron T. Kelley and Hugh H. Miller. Issued Jan. 15, 1952. 19p. (ORNL-842)

A high-sensitivity recording polarograph with useful sensitivities down to 0.01 μa for full-scale deflection is described. A linear compensator for condenser current is incorporated in the instrument and also a "curve follower," which will subtract a blank curve from the recorded polarogram. The instrument has been applied to determine the diffusion current for reduction of Pb in the concentration range 0.2×10^{-6}M to 2.0×10^{-6}M (0.04 to 0.4 ppm).

1164

Jet Propulsion Lab., Calif. Inst. of Tech.

A CALORIMETER FOR CORROSIVE LIQUIDS; PROGRESS REPORT; by B. H. Sage and E. W. Hough. June 16, 1947. 36p. (JPL-PR-1-52)

A calorimeter is described which is suitable for the measurement of the heat capacity of corrosive liquids at temperatures up to 400°F. The calorimeter is believed to be capable of yielding results involving uncertainties of less than 1% as long as the rates of corrosion and decomposition with their associated thermal effects are sufficiently small that additional uncertainties are not introduced.

MOLECULAR STRUCTURE

1165

Brookhaven National Lab.

THE MICROWAVE SPECTRA OF POF_3 AND PSF_3; by Norval J. Hawkins, V. W. Cohen, and W. S. Koski. Brookhaven National Lab. and Johns Hopkins Univ. [nd] 3p. (BNL-1047)

The microwave spectra of $PS^{32}F_3$, $PS^{34}F_3$, $PO^{16}F_3$, and $PO^{18}F_3$ has been obtained with a 100-kc Stark-modulated spectrometer. The following bond distances have been calculated: a P−S distance of 1.86 A and a P−F distance of 1.53 A in PSF_3; a P−O distance of 1.48 A and a P−F distance of 1.52 A in POF_3. The dipole moments of PSF_3 and POF_3 have been calculated to be 0.633 ± 3% and 1.69 ± 3%, respectively. The P−F and P−S bond distances reported are appreciably smaller than the corresponding double-bond distances listed by Pauling. This shortening of the bonds and the observed dipole moment is attributed to 3d orbitals, triple-bond contribution, and ionic character of bonds in various resonance structures.

1166

Brookhaven National Lab.

ANISOTROPY IN PARAMAGNETIC RESONANCE ABSORPTION OF PICRYL-n-AMINO CARBAZYL; by Victor W. Cohen, C. Kikuchi, and John Turkevich. Brookhaven National Lab. and Princeton Univ. Dec. 5, 1951. 7p. (BNL-1052)

The paramagnetic resonance of crystals of a new free organic radical, picryl-n-amino carbazyl, has been studied and compared with that of α,α-diphenyl-β-picryl hydrazyl. Angular dependence of the resonance peak on the orientation of the crystalline axis was found, the peak varying over a range of 7 gauss as compared to 5 gauss for the hydrazyl. The effective g-value limits are 2.0024 and 2.0041. In one sample the absorption spectrum consisted of two lines, one of which showed no directional effect and one which depended strongly on the orientation of the sample. These results seem to indicate that the observed angular dependence is due to molecular diamagnetism.

RADIATION CHEMISTRY

1167

CHEMICAL REACTIONS OF NASCENT C^{14}; FORMATION OF RADIOACTIVE NAPHTHALENE AND OTHER COMPOUNDS FROM QUINOLINE OXALATE. Ugo Croatto, Giordano Giacomello, and A. G. Maddock. Ricerca sci. 21, 1598-601(1951) Sept. (In Italian)

A 5-g sample of quinoline oxalate was neutron-irradiated in the BEPO pile for 2 weeks. The distribution of radioactivity in the compounds formed was 8.4% in naphthalene, 2.2% in α-naphthol, 7.1% in oxalic acid, 1.6% in quinoline, and the remainder in an orange-red basic mixture. Only traces of active CO and CO_2 were found. The mechanism of formation and the position of C^{14} in the aromatic products are discussed.

RADIATION EFFECTS

1168

PHOTOELECTRIC INVESTIGATIONS ON NATURALLY COLORED ROCKSALT, ON RADIATION-COLORED FLUORITE, AND ON VITREOUS BORAX. Johann Urbanek. Acta Phys. Aust. 5, 69-76(1951) Nov. (In German)

The primary photoelectric current of naturally yellow rock salt has been determined; its spectral distribution is the same as artificially colored NaCl. No difference could be found with respect to photoelectric behavior between naturally blue and violet rock salts and a violet rock salt

made blue by heat-treatment. The spectral distribution of the secondary photoelectric current of an x-irradiated natural (Sarntal) fluorite has been measured; the maximum photoelectric effect was found in the ultraviolet. No photoelectric conduction was found in glassy borax colored by Ra radiation.

1169

IRRADIATION OF ALCOHOLIC SOLUTIONS WITH X RAYS. W. Minder. J. chim. phys. 48, 423-8(1951) Sept.-Oct. (In French)

Various halogenated hydrocarbons (including DDT) were x irradiated in alcoholic solution, and the HCl or other halogen acid formed was extracted with water. Details are given for γ-hexachlorocyclohexane. Concentration of the HCl was proportional to the x-ray dosage. Yield of the radiochemical reaction depended on the concentration, but not in a simple manner. The yield was of the same order of magnitude as that in aqueous solution. At weak concentrations the reaction may be considered indirect, the solvent acting as energy receptor and transporter. The transport agents have not been identified, but can hardly be the H and OH radicals. At high concentrations a direct reaction on the solute is added to the indirect one; this increases proportionally to the concentration and may be calculated from the absorption ratio between solvent and solute.

1170

THE EFFECTS OF DEUTERON BOMBARDMENT ON THE CHEMICAL COMPOSITION AND CARCINOGENICITY OF ORGANIC COMPOUNDS. Benjamin Franklin Barnes. Univ. Wyo. Pub. 16, 82-8(1951) July 15.

The effects of D bombardment on the chemical composition and carcinogenicity in mice of organic compounds are described. The cholesterol was changed from a white crystalline nonfluorescent material to a light-yellow powder, which fluoresced in ultraviolet light. The physiological action of irradiated cholesterol seemed to be the same as that of unirradiated material, except for the fact that a slight stimulation of growth was observed for a short period after injection. The bombardment of 20-methylcholanthrene, 1,2,5,6-dibenzanthracene, and 9,10-dimethyl-1,2-benzanthracene caused changes which probably included dehydration, polymerization, decomposition, hydrogenation, and oxidation. Slight initial changes resulted in little if any change in the carcinogenic activity. More profound changes caused a more or less complete loss of carcinogenicity. Slight initial changes in 1,2-benzanthracene resulted in a product which was apparently carcinogenic; more involved changes yielded a noncarcinogenic product. In more than 95% of the cases the developing tumors were fibrosarcomas.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1171

Ames Lab.

PREPARATION OF RARE EARTH METALS; by F. H. Spedding and William J. McGinnis. June 1951. 34p. (ISC-149)

The production of over 400 g of pure Gd metal by reduction of the anhydrous chloride by Ca in Ta vessels is described; yields were over 97%. The use of the same techniques in an attempt to prepare Y metal were partially successful. (auth)

SEPARATION PROCEDURES

1172

Oak Ridge National Lab.

THE ENZYMATIC DEGRADATION PRODUCTS OF RIBONUCLEIC ACID (abstract); by Elliot Volkin and Waldo E. Cohn. [nd] 1p. (AECU-1806)

The 5′ nucleotides of ribonucleic acids (RNA), previously isolated in small amounts from intestinal phosphatase digests, have now been quantitatively recovered with the use of purified snake venom diesterase. The 5′ nucleotides of venom diesterase digests are recovered in about 80% yield, while the remainder can be accounted for as purine nucleosides and pyrimidine diphosphates in approximately equivalent amounts. The new compounds have been characterized as the 2′,5′ and/or 3′,5′ diphosphates of cytidine and uridine. Since the same RNA's hydrolyzed with alkali yield exclusively 2′ and/or 3′ nucleotides, the major internucleotide link is considered to be 2′,5′ and/or 3′,5′. The next question, with respect to the structure of RNA, is that of sequence of nucleotides and of branch points. An excellent system for such a study is the pancreatic ribonuclease digest, where the limit reaction products consist in a large variety of polynucleotides, in addition to 70% of the pyrimidines as b nucleotides. It has been found possible to fractionate such a mixture by ion exchange. The purified polynucleotide products are then characterized by analysis with the above-mentioned enzymes, together with others of different specificities, e.g., Schmidt's prostatic phosphatase, which hydrolyzes only end-group phosphoryl groups, and the spleen nuclease of Maver and Greco (J. Biol. Chem. 181, 861-70(1949)), which we found to liberate only b nucleotides (and a guanylic) from RNA. From an analysis of this type, an attempt can be made to reassemble the degradation products into a structure representative of intact RNA. (Entire report. Abstract of paper for N.Y. meeting of Am. Soc. of Biological Chemists (Fed. Am. Soc. Exptl. Biol.), Apr. 14-18, 1952.)

1173

[Columbia Univ. School of Mines]

THE STUDY OF THE ELECTRODEPOSITION OF ZIRCONIUM FROM FUSED SALTS; REPORT. . . COVERING PERIOD JUNE 1 TO NOVEMBER 30, 1951; by H. H. Kellogg, David Aaron, Joseph T. Benedict, and Lawrence J. Howell. [nd] (NYO-3106; Progress Report No. 1)

A general discussion of the plan of attack and some details on the experimental methods to be employed in the subject research project are given. No experimental results are given.

1174

FRACTIONATION OF LANTHANUM–CERIUM(III) AND LANTHANUM–PRASEODYMIUM MIXTURES BY PRECIPITATION FROM HOMOGENEOUS SOLUTION. Louis Gordon, R. A. Brandt, Laurence L. Quill, and Murrell L. Salutsky. Anal. Chem. 23, 1811-12(1951) Dec.

A comparison is made of the efficiency of homogeneous and heterogeneous fractional precipitation methods using standard La, Ce, and Pr mixtures. In the conventional method for the fractional precipitation of rare earth oxalates, oxalic acid is added directly to a rare earth solution. Heterogeneous precipitations of this type are not so efficient as methods in which the precipitant is homogeneously produced within the solution. In this investigation rare earth oxalates are precipitated from homogeneous solution by the addition of oxalate ions internally through the hydrolysis of dimethyl oxalate. For the experimental conditions described, 10 fractionation steps by the homogeneous method are equivalent to 17 steps by the heterogeneous method. The homogeneous method is more efficient as a greater yield of product of desired purity is obtained with fewer fractionation steps. (auth)

1175

ION-EXCHANGE SEPARATION OF HAFNIUM AND ZIRCONIUM. I. E. Newnham. J. Am. Chem. Soc. 73, 5899(1951) Dec.

The method of Street and Seaborg (J. Am. Chem. Soc. 70, 4268(1948)) for separating milligram quantities of HfO_2 -

ZrO_2 mixtures on Dowex 50 has been applied to 2-g mixtures containing 20% HfO_2. The Hf contents of successive fractions listed in order of collection were

Fraction No.	Total HfO_2 recovered, %	HfO_2 content of fraction, %
1	42	99.9
2	18	90
3	10	75
4	10	52
5	10	34

SYNTHESES

1176

Argonne National Lab.

THE EXCHANGE OF HYDROGEN GAS WITH LITHIUM AND SODIUM BOROHYDRIDES; by W. G. Brown, Louis Kaplan, and K. E. Wilzbach. Oct. 22, 1951. 5p. (AECU-1818; UAC-457)

A direct exchange of alkali-metal borohydrides with H has been found to provide a more simple route to the isotopic compounds. Results of a number of exchange experiments, traced with tritium, are tabulated. The amount of tritium in the solid was calculated from the change in tritium content, measured by ion current, of the gas.

1177

Louisville Univ.

SYNTHESIS AND PROPERTIES OF ION EXCHANGE RESINS; PROGRESS REPORT NO. 2. Sept. 30, 1951. 7p. (AECU-1832)

Research programs and technical progress in the synthesis of sulfo- and phosphono-styrenes and in ion-exchange equilibrium studies are described.

1178

A NEW SYNTHESIS OF 1-GLYCOSYLBENZIMIDAZOLES. John Davoll and George Bosworth Brown. J. Am. Chem. Soc. 73, 5781-2(1951) Dec.

1-Glycosylbenzimidazoles are prepared in good yield by condensation of polyacetylglycosyl halides with chloromercuribenzimidazoles, followed by deacetylation of the reaction products. (auth)

1179

THE PREPARATION OF ALPHA C^{14}-LABELED PYRUVIC ACID AND A STUDY OF THE HYDROLYSIS OF PYRUVONITRILE. R. C. Thomas, Jr., C. H. Wang, and Bert E. Christensen. J. Am. Chem. Soc. 73, 5914(1951) Dec.

The older procedures employing aqueous hydrolysis of pyruvonitrile either give low over-all yields 20 – 25% (based on acetate), or a product which is unsatisfactory owing to the incomplete removal of an acid contaminant in the pyruvic acid, probably acetic acid. For these reasons the hydrolysis of pyruvonitrile in an ethereal medium as described by Anker (J. Biol. Chem. 176, 133(1949)) has been modified and adapted to a larger scale operation for the preparation of pyruvic acid from sodium acetate. This procedure gives an over-all yield of 40% of a 98% pyruvic acid based both on radioactivity measurements and the quantity of sodium acetate used.

1180

THE PREPARATION OF MORPHINE-N-METHYL-C^{14}. Henry Rapoport, Calvin H. Lovell, and Bert M. Tolbert. J. Am. Chem. Soc. 73, 5900(1951) Dec. (cf. NSA 5-7048)

Since codeine-N-methyl-C^{14} can be readily prepared in the manner described by von Braun the most attractive path to the corresponding morphine compound would be through cleavage of the 3-methoxyl group. Although this cleavage reaction has been used to convert some codeine derivatives to their morphine analogs, no successful application of this reaction to codeine itself has been reported. The usual ether-cleaving reagents (concentrated hydrogen iodide and hydrogen bromide, in aqueous solution or in glacial acetic acid) appear to be too drastic. However, pyridine hydrochloride under carefully controlled conditions effected the cleavage of codeine to morphine in a reasonable yield (22%), and hence was applied to the preparation of morphine-N-methyl-C^{14} from codeine-N-methyl-C^{14}.

1181

SYNTHESIS OF BUTADIENE-2,3-C^{14}. Kingsley M. Mann and Robert F. Nystrom. J. Am. Chem. Soc. 73, 5894-5(1951) Dec.

The synthesis of tagged butadiene is an eight-step process, furnishing an over-all yield of 49% based on radioactive CO_2. The method briefly outlined is (a) conversion of $C^{14}O_2$ to methylene-labeled succinic acid (four steps) in an 89% yield by modification of the procedure of Kushner and Weinhouse (J. Am. Chem. Soc. 71, 3558(1949)); (b) esterification of the acid; (c) reduction of the ester to 1,4-butanediol-2,3-C^{14} by lithium aluminum hydride; (d) conversion of the diol to 1,4-dibromobutane-2,3-C^{14}; and (e) reaction between the dibromide and trimethylamine to give the diquaternary salt, which upon treatment with silver oxide and heating furnishes butadiene-2,3-C^{14}.

Terminal-labeled butadiene-1,4-C^{14} can be made from carboxyl-labeled succinic acid utilizing steps (b) through (e).

TRACER APPLICATIONS

1182

Brookhaven National Lab.

EFFECT OF OXYGEN ON THE FERROUS-FERRIC EXCHANGE REACTION; by Lois Eimer, A. I. Medalia, and R. W. Dodson. [nd] 8p. (BNL-1034)

It has been proposed by Weiss (J. Chem. Phys. 19, 1066 (1951)) that the rapid exchange observed in aqueous solutions between metal ions in different valence states may involve the oxidation and reduction of the metal ions by substances present in the solution, such as O_2, H_2O, Br^-, etc. In aqueous solutions of ferrous and ferric ions in the presence of O_2, exchange might occur according to the following mechanism: $Fe^{++} + O_2 \rightarrow Fe^{+3} + O_2^-$; $Fe^{+3} + O^{2-} \rightarrow Fe^{++} + O_2$. This proposal has been tested by measuring the rate of this reaction with Fe^{55} as tracer while varying the disolved O_2 concentrate by a factor of 5000. The rate of ferrous-ferric exchange was not significantly affected, indicating that the Weiss mechanism was not operative.

URANIUM AND URANIUM COMPOUNDS

1183

Knolls Atomic Power Lab.

A SUPPLEMENTARY NOTE ON THE CRYSTAL STRUCTURE OF BETA URANIUM; by Charles W. Tucker, Jr. [nd] 8p. (AECU-1807)

Several points of controversy which have developed since the author's report on the crystal structure of the β phase of U (AECD-2957) are discussed. It was suggested by Bergman and Shoemaker (J. Chem. Phys. 19, 515(1951)) that the layers in β uranium are flat. Data obtained from Weissenberg patterns with the crystal rotating about the twofold axis are now presented to demonstrate that the layers cannot be flat. Thewlis (Nature 168, 198(1951)) has raised questions based on powder-pattern data regarding the identity of the β phase structure from the pure metal, and that from the 1.4 at. % Cr alloy, and his criticisms are briefly considered.

WASTE DISPOSAL

1184
Vitro Corp. of America
SUMMARY PROGRESS REPORT; NOVEMBER, 1951; DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT; JOB 24-A. Dec. 14, 1951. 4p. (KLX-1369)

Favorable results indicate that the use of the Fe form of National Aluminate cationic resin (HCR-Fe) as part of the cartridge charge in the waste-disposal unit is beneficial for decontamination of tap water.

ENGINEERING

1185
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DESIGN OF MASS FLOWMETERS FOR LARGE FLOWS; FLOW-SHUNTS; by H. Kronberger. Oct. 18, 1951. 14p. (AERE-G/R-784)

A flowmeter is described which has a range up to about 6 kg of hydrogen per hour (about 70,000 liters/hr) on a scale linear to ½%. The instrument consists of a standard mass flowmeter as described in Report BR-556, and a flow-shunt in parallel, the branching ratio being of the order of 100,000. Design rules for shunts of constant branching ratio are given. (auth)

1186
Oak Ridge National Lab.
THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; N. F. Lansing, comp., Oak Ridge National Lab. and Oak Ridge Inst. of Nuclear Studies. Dec. 1951. 516p. (TID-5031)

This is a complete compendium of papers on this subject. Separate abstracts have been prepared on the following: Engineering and the Objectives of the Atomic Energy Commission, T. Keith Glennan, p.1-15; Some Economic Aspects of Atomic Power, C. G. Suits, p.16-33; The Atomic Energy Commission Reactor Program, Lawrence R. Hafstad, p.34-57; The Contributions of Engineering to Nuclear Energy Development, J. A. Lane, p.58-83; Underlying Concepts of Nuclear Physics, Arthur H. Snell, p.84-151; A Simplified Approach to Reactor Calculation, A. V. Masket, p.152-175; Standards of Radiological Protection and Control, Karl Z. Morgan, p.176-209; Chemical Problems in the Development of Nuclear Reactors, J. A. Swartout, p.210-243; Separation of Stable Isotopes, Manson Benedict, p.244-271; Materials of Reactor Construction, G. E. Evans, p.272-301; Heat Transfer Problems in Nuclear Reactors, Richard N. Lyon, p.302-310; Instrumentation and Control of Reactors, J. D. Trimmer, p.311-331; Nuclear Radiation Shielding Principles, E. P. Blizard, p.332-352; Environmental Problems of Radioactive Waste Materials, Roy J. Morton, p.353-399; The Treatment of Radioactive Wastes, W. K. Eister, p.400-409; Hazards of Low Power Research Reactors, M. M. Mills, p.411-421; A Survey of Reactor Types, Neal F. Lansing, p.422-449; The Scope of Nuclear Engineering, A. M. Weinberg, p.453-459; The Impact of Atomic Energy upon Training of the Professional Engineer, L. M. K. Boelter, p.459-463; The Oak Ridge School of Reactor Technology and Development Engineering Education, F. C. Vonderlage, p.463-471; Report on Preliminary Survey of Current Nuclear Engineering Courses, Robert Ernst, p.471-475; and Training in Nuclear Engineering, Clifford Beck, p.475-485.

1187
Atomic Energy Commission
ENGINEERING AND THE OBJECTIVES OF THE ATOMIC ENERGY COMMISSION, p.1-15 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by T. Keith Glennan. Dec. 1951. (TID-5031(p.1-15))

The following topics are considered: the role of and problems faced by the engineers in the Atomic Energy Program, the problems of in-service and pre-service training of nuclear engineers, and the problem of distribution of current nuclear engineering information to the educators so that they will know what to teach without violating the security of this country.

1188
Oak Ridge National Lab.
THE CONTRIBUTIONS OF ENGINEERING TO NUCLEAR ENERGY DEVELOPMENT, p.58-83 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by J. A. Lane. Dec. 1951. (TID-5031(p.58-83))

An over-all picture of the engineering participation in the field of nuclear power is presented. The unique problems of nuclear engineering center mainly around the design, construction, and operation of a nuclear reactor and the handling of the products of the nuclear reaction. It is obvious from this talk that the success of the atomic energy program will depend on the availability of adequately trained engineers from the universities. This does not mean highly trained specialists in nuclear physics, but engineers with a sound conventional engineering background, some proficiency in higher mathematics, and a working knowledge of the fundamental nuclear concepts. If, in addition to this training, engineers are equipped with the three important tools of nuclear engineering, imagination, philosophy, and an understanding of politics, the development of industrial atomic power will be assured.

1189
Oak Ridge National Lab.
MATERIALS OF REACTOR CONSTRUCTION, p.272-301 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by G. E. Evans. Dec. 1951. (TID-5031(p.272-301))

The problem of selecting suitable construction materials for use in a given nuclear reactor is a highly complex problem, depending on an accurate evaluation of such factors as its physical properties, nuclear properties, mechanical properties, cost, availability in an acceptably pure form, susceptibility to radiation damage, corrosion resistance, and in some cases, its resistance to high temperatures. These properties of different materials and the methods used in testing are discussed.

1190
Oak Ridge National Lab.
THE SCOPE OF NUCLEAR ENGINEERING, p.453-459 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by A. M. Weinberg. Dec. 1951. (TID-5031(p.453-459))

This talk is divided into three parts: (1) Is there a future for nuclear technology? (2) What do we know about the scope of nuclear technology? and (3) What is a reasonable program for education for nuclear technology? The answers to the first two questions are obvious, yes and very broad, respectively. For the third question no direct answer can

be given since the field of nuclear engineering is so new; because of this, it is impossible to predict the type of training necessary, but it is evident that any education in such a new field must be primarily a broad education. We do know that nuclear technology at the very least is a synthesis of chemical engineering and heat power engineering.

1191

California Univ., Los Angeles

THE IMPACT OF ATOMIC ENERGY UPON THE TRAINING OF THE PROFESSIONAL ENGINEER, p.459-463 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by L. M. K. Boelter. Dec. 1951. (TID-5031(p.459-463))

It is concluded that, unless the engineering colleges accept the responsibility for storing, transmitting, and enlarging knowledge in the nuclear-science area, the several research and development agencies now in existence will of necessity become repositories and transmitters of knowledge, i.e., become engineering schools. The objectives and content of the introductory college course in physics and chemistry must reflect knowledge in nuclear physics and radiochemistry. Equally important will be the introduction of some advanced courses in physics and chemistry into the engineering curricula in order that engineers reflect the philosophy and knowledge of the physical scientist.

1192

Oak Ridge National Lab.

THE OAK RIDGE SCHOOL OF REACTOR TECHNOLOGY AND DEVELOPMENT ENGINEERING EDUCATION, p. 463-471 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by F. C. Vonderlage. Dec. 1951. (TID-5031(p.463-471))

The development of the Oak Ridge School of Reactor Technology is described. This includes a description of the curriculum and a listing of the content of the courses. The purpose of the school is to provide advanced, specialized training in reactor theory and technology to engineers and scientists in order to develop the art of successful reactor development and design.

1193

Louisville Univ.

REPORT ON PRELIMINARY SURVEY OF CURRENT NUCLEAR ENGINEERING COURSES, p. 471-475 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Robert Ernst. Dec. 1951. (TID-5031(p.471-475))

Results of a questionnaire sent to 120 colleges asking the question, "What are you doing in your school in nuclear engineering?" are given. The highlights of the nuclear-engineering training as reported from the different schools are reviewed. This gives a good picture of what is being done to train nuclear engineers.

1194

North Carolina State Coll.

TRAINING IN NUCLEAR ENGINEERING, p. 475-485 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Clifford Beck. Dec. 1951. (TID-5031(p.475-485))

The curriculum at North Carolina State College leading to a B.S. or M.S. degree in nuclear engineering is described. The problems of incorporating this new program into an existing curriculum are discussed. The nuclear engineering curriculum is unique in that it places (1) more emphasis on general cultural and basic science courses, (2) less emphasis on specialized courses relating to the narrow field of interest and (3) much more opportunity for technical electives.

1195

MUTUAL INTERESTS OF THE WATER WORKS AND ATOMIC ENERGY INDUSTRIES. Arthur E. Gorman. J. Am. Water Works Assoc. 43, 865-71(1951) Nov.

Possible effects of industrial and military uses of atomic energy upon water utilities are discussed. The need for water-works officials to have an understanding of this new industry and its products in order to help solve the problems of water supply and waste disposal as they arise is stressed.

HEAT TRANSFER AND FLUID FLOW

1196

Jet Propulsion Lab., Calif. Inst. of Tech.

AN EXPERIMENTAL STUDY OF THE FLOW OF GAS THROUGH POROUS METALS; by Pol Duwez and H. L. Wheeler, Jr. Aug. 7, 1947. 50p. (JPL-PR-1-66)

The results of experiments have shown that efficient cooling can be achieved by forcing a fluid through a porous metal exposed to high rates of heat transfer. The method, generally known as sweat cooling, is applicable whether the cooling fluid is a liquid or a gas. An important problem connected with the design of sweat-cooled parts is the study of the flow of liquids and gases through porous metal. The results of an experimental study of the flow of gases through porous metals are discussed. Several porous metals, namely, copper, stainless steel, iron, and nickel, having various porosities, have been investigated. Nitrogen and hydrogen have been used as representative gases. The range of flows covered in the present work varies from 10^{-6} lb/in.^{2}/sec to 10^{-2} lb/in.^{2}/sec. The pressure drop was as high as 160 lb/in.^{2}, through specimens ¼ in. thick. The results are presented in curves relating the difference of the squares of the pressures on the two sides of a specimen to the weight rate of flow. (auth)

1197

North American Aviation, Inc.

GAS COOLING OF A POROUS HEAT SOURCE; by L. Green, Jr. Issued Dec. 13, 1951. 29p. (NAA-SR-163)

A limiting case of solid-fluid heat transfer is examined, in which a gas passes through a porous wall of high specific surface with heat generation within the solid material. Dimensionless temperature profiles in the wall are presented in terms of the rate of heat generation, rate of flow, and thermal properties of the gas and solid. The pressure drop across the wall is approximated by using an average wall temperature and assuming isothermal conditions. Temperature profiles, pressure drops, and pumping-power/power-output ratios are calculated for the hypothetical case of a heated graphite wall cooled by helium. It is found that the thermal dependence of the gas viscosity may produce a minimum in the pressure-drop vs. flow-rate curve, and it appears that favorable pumping-power-output-ratios can be obtained by the use of high pressures. The problem of temperature stability in a gas-cooled porous solid is pointed out and the need for experimental work emphasized. Use of the sweat-cooling technique for high-pressure, high-temperature ducts is suggested. (auth)

1198

Christ's Coll., Cambridge Univ. (England)

HEAT TRANSFER PROPERTIES OF LIQUID METALS; by Lloyd MacGregor Trefethen. July 1, 1950. 222p. (NP-1788)

A study has been made of the transfer of heat to and from liquid metals in annuli and circular tubes. An experimental circuit was developed for testing Hg in the range of Reynolds numbers from ~4,000 to ~100,000 and at a Prandtl number

of 0.02. The resulting data appear to be consistent and accurate. They indicate that calculations based on the momentum transfer theory for turbulence do not adequately predict heat transfer coefficients for low Prandtl number fluids. Calculations based on the verticity transfer theory appear to be approximately accurate; such calculations, however, fail to predict heat transfer coefficients for low-conductivity fluids such as water and air. Data from tests on both wetted and non-wetted surfaces were, within the experimental limitations of the apparatus, identical. Data for several annuli were obtained. A simple method, based on "rod" flow calculations, is suggested for predicting heat transfer to liquid metals in turbulent flow through annuli. The appendix discusses the general problem of laminar flow heat transfer in annuli. An exact solution is derived for the condition of constant axial temperature gradient. The complications introduced by such practical considerations as entry effects are examined, and the few experimental data available are briefly analyzed. (auth)

1199

Massachusetts Inst. of Tech.

HEAT TRANSFER TO MERCURY (thesis); by Robert J. Musser and William R. Page. May 23, 1947. 60p. (NP-3579)

1200

Institute of Engineering Research, Univ. of Calif.

HEAT TRANSFER TO MOLTEN LEAD-BISMUTH EUTECTIC IN TURBULENT PIPE FLOW, JUNE 1, 1950–JUNE 30, 1951; FINAL REPORT; by H. A. Johnson, J. P. Hartnett, and W. J. Clabaugh. Nov. 15, 1951. 105p. (ORO-55)

Experimental heat-transfer data and results for molten Pb-Bi eutectic are presented for turbulent flow in a ¾-in., 18-gage, mild-steel tube with constant heat flux. The data reported are for non-wetted conditions since the Pb-Bi alloy always drained free and showed no tendency to "tin" the mild-steel surfaces. Validity of the measurement technique was indirectly established by identical tests with water which agreed with predicted heat-transfer performance for that fluid. Correlations of the Pb-Bi results are given for the Peclet modulus range from 700 to 3000 at Prandtl moduli of 0.024, 0.029, and 0.044. The resulting Nusselt moduli are compared with those obtained both experimentally and theoretically by others. Local heat-transfer coefficients at the start of the heated section are also presented and reveal that the thermal-entrance length is less than 30 pipe diameters.

1201

Oak Ridge National Lab.

HEAT TRANSFER PROBLEMS IN NUCLEAR REACTORS, p.302-310 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Richard N. Lyon. Dec. 1951. (TID-5031(p.302-310))

A discussion is given of the following heat-transfer problems which face the reactor project: physical properties of the solids and fluids used in reactors; better fundamental knowledge of forced convection heat transfer, including velocity-distribution data, eddy Prandtl number, and composite problems involving both conduction in solids and forced convection; experimental work on a wide variety of fluids in experiments which are well worked out; better understanding of the phenomena of ordinary and subcooled boiling; and, finally, a reasonable supply of well-trained engineers. For these engineers, a good mathematics background and a good mechanical ability are the basic requirements. The heat-transfer problems in reactors involve no unique principles. They simply require a revised emphasis. Such a revision can best be accomplished by good comprehension of the basic principles which govern the flow of heat.

120?

HEAT EMISSION BY BODIES OF VARIOUS SHAPES IN LIQUIDS AND GASES WITH FREE CIRCULATION. Hermann Senftleben. Z. angew. Physik 3, 361-73(1951) Oct. (In German)

A method of calculating the heat given off by heated bodies in freely circulating gases or liquids is developed which is capable of treating both special and general cases. Complete calculations are given for vertical plates and horizontal and vertical cylinders. Agreement with experimental results is shown.

1203

THE INFLUENCE OF ELECTRIC FIELDS ON THE CONVECTIVE HEAT TRANSFER IN LIQUIDS II. H. J. De Haan. Applied Sci. Research (Netherlands) A3, 85-8(1951).

The measurements of Ahsmann and Kronig on the change brought about in the heat transfer from a horizontal wire to a coaxial cylinder when the intervening liquid is subjected to an electric field between the two conductors are extended to wires of different diameter and to different values of the temperature of the liquid. (auth)

1204

DIMENSIONAL ANALYSIS AND THEORY OF MODELS. Henry Langhaar. New York, John Wiley & Sons, Inc., 1951. 166p.

The following abstract by Warren E. Winsche appeared in J. Am. Chem. Soc. 73, 5924(1951) Dec. and is reproduced here in its entirety.

The study of physical phenomena (heat transfer, fluid dynamics, elasticity, etc.) has been simplified by the application of dimensional analysis. Instead of having to consider the relationship between all the variables involved in a problem, it is necessary only to consider those between groups of the variables. These groups consist of products of powers to the original variables taken in such a way as to make the group dimensionless. Model studies for which these groups have the same numerical values as a full-scale prototype faithfully reproduce the performance of the prototype. Professor Langhaar's book provides a systematic way of determining these groups as well as a wide variety of applications to current engineering problems. The presentation is clear and thorough. For those interested in the application of these methods to chemical systems, an additional reference is the paper by R. Edgeworth-Johnstone (Trans. Inst. of Chem. Engrs. (London) 17, 129(1939)).

1205

ON THE LIBERATION OF GASES BY LAMINARLY FLOWING LIQUIDS. Frank C. Roesler. Z. angew. Physik 3, 376-9(1951) Oct.

Certain relations between the velocity of laminar flow of a liquid supersaturated with gas and the rate of separation of the gas are derived.

MATERIALS TESTING

1206

New Mexico Univ.

PUMICE AS AGGREGATE FOR LIGHT WEIGHT STRUCTURAL CONCRETE; by William C. Wagner, Walter E. Gay, and Dexter H. Reynolds, New Mexico University and Los Alamos Scientific Laboratory. [nd] 35p. (AECU-1831; LADC-868)

This investigation included preparation of a large number of trial and final mix designs. These used pumice as it came from the pit, modified by simple screening, grinding, and blending with hard sand; pumice graded "ideal" by U. S. Bureau of Reclamation standards; and a "new ideal" grading

derived from experiences of the preceding work. Altogether, 59 trial mixes were made. The composition, aggregate gradation, appearance, workability, placeability, consistency, bleeding, shrinkage, unit weight, and compressive strengths after fog-room curing for 7 and 28 days were recorded for each mix. From analyses of the results of the trial mixes, 21 compositions were chosen for exhaustive examination, and large-scale mixes were made to allow preparation of the many test specimens required. Studies made on the final mix designs included tests of consistency, unit weight, and measurement of air entrainment on the wet concrete; compressive strengths at 7, 28, 90, and 365 days; modulus of elasticity at 28 days; flexural strength at 7 and 28 days; shear strength at 28 days; steel bond strength at 28 days; grout tensile strength at 28 days; dry unit weight; 24-hr water absorption; thermal coefficient of expansion; thermal breakdown at 315 and 1000°F freeze-thaw tests; and thermal-conductivity measurements.

1207
Michigan Univ.
FUNDAMENTAL EFFECTS OF COLD-WORK ON SOME COBALT-CHROMIUM-NICKEL-IRON BASE CREEP-RESISTANT ALLOYS; by D. N. Frey, James W. Freeman, and Albert Easton White. Jan. 1952. 12p. (NACA-TN-2586)

The influence of cold-working on creep properties of an alloy containing 20% Co, 20% Cr, 20% Ni, and the balance Fe, and on the same alloy modified by small additions of W alone or W, Mo, and Nb in combination was studied. Effects of cold-working on creep resistance were the same for all alloys studied for temperatures up to 1600°F and reductions between 15 and 40%. Conclusions were reached by studying creep properties and also internal stress relaxation at test temperatures which previous work had shown to be the controlling factor in response of such alloys to cold-working.

VACUUM SYSTEMS

1208
A HIGH-VACUUM-PUMP STAND FOR THE LABORATORY. H. Boersch. Z. Physik 130, No. 4, 513-16(1951). (In German)

The vacuum pump, forepump, and control are mounted in a framework on wheels, facilitating laboratory use.

1209
NOTES ON THE IONIZATION GAUGE. L. Riddiford. J. Sci. Instruments 28, 375-9(1951) Dec.

The sensitivity of the hot-filament ionization gauge is in good agreement with theoretical values calculated on the basis of a physical picture of a stream of electrons passing to and fro through the ionizing space. The calibration curve is not exactly linear, the sensitivity decreasing as the pressure increases from 10^{-4} to 10^{-3} mm of mercury. The tungsten filament in such a gauge "pumps" oxygen at a rate which is in agreement with earlier work of Langmuir. The remanent molecules which determine the ultimate pressures of diffusion pumps are strongly adsorbed by the gauge, which behaves as a pump of constant speed S. An account of the nature of this phenomenon is given. (auth)

1210
A VACUUM MANIFOLD. H. Boersch. Z. Physik 130, No. 4, 517-20(1951). (In German)

The manifold is made up of individual interchangeable sections, permitting flexible, rapid, and leakproof assembly of laboratory vacuum systems.

WASTE DISPOSAL

1211
[Hanford Works]
TREATMENT OF RADIOACTIVE WASTE SOLUTIONS; by [Charles E. Hirsch.] [nd] Decl. with deletions Jan. 4, 1952. 8p. (AECD-3291)

Hanford waste solutions are now reduced 75% in volume by semibatch evaporation before storage in underground tanks as a sludge of approximately 41.8% dissolved-solids content and 1.38 specific gravity. A schematic flow diagram of the evaporation process is given, and problems of foaming, deentrainment, sludge crystallization, control, etc., are discussed briefly. Average steam consumption is 1.21 lb/1.0 lb of waste-solution condensate. The cost per gallon of waste solution treated is $0.05 compared to $0.37/gal for underground waste-solution storage.

1212
Oak Ridge National Lab.
ENVIRONMENTAL PROBLEMS OF RADIOACTIVE WASTE MATERIALS, p.353-399 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Roy J. Morton. Dec. 1951. (TID-5031(p.353-399))

A discussion concerned primarily with health problems that result from the escape or release of radioactive materials to the environment is given. The potential health hazards from radioactive wastes are considered with regard to other problems of public health and environmental sanitation. The significance of environmental control and the essentials of waste disposal in general are briefly reviewed, while the problem of radioactive wastes is considered more specifically.

1213
Oak Ridge National Lab.
THE TREATMENT OF RADIOACTIVE WASTES, p.400-409 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by W. K. Eister. Dec. 1951. (TID-5031(p.400-409))

The following problems of radioactive-waste treatment and disposal are considered: (1) the objective of waste control, (2) the characteristics of the radioactive wastes, (3) the control of radioactive-waste disposal, (4) the general procedures for disposal, (5) the types of radioactive wastes, (6) the processes used for waste concentration, and (7) the method of final disposal.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1214
ON ELECTRON CONDUCTIVITY IN POLYCRYSTALLINE ANNEALED TITANIUM DIOXIDE. S. I. Gorelik. Zhur. Eksptl'. i Teoret. Fiz. 21, 826-32(1951) July. (In Russian)

1215
ON HIGH-VOLTAGE POLARIZATION IN POLYCRYSTALLINE ANNEALED TITANIUM DIOXIDE. S. I. Gorelik and V. E. Tolstoĭ. Zhur. Eksptl'. i Teoret. Fiz. 21, 833-8(1951) July. (In Russian)

1216
REFRACTORY BODIES COMPOSED OF BORON AND TITANIUM CARBIDES BONDED WITH METALS. James A. Nelson, Tracy A. Willmore, and Raymond C. Womeldorph. J. Electrochem. Soc. 98, 465-73(1951) Dec.

When mixtures of boron and titanium carbides in finely divided form were compacted with several different metals

and fired in an argon atmosphere at 1925 to 2065°C, the following reactions took place: the two carbides alone formed TiB_2 and graphite. Boron carbide reacted with Fe, Co, Ni, Cr, and Ti to form borides of metals and free graphite. No chemical reaction was detected between titanium carbide and Fe, Ni, Co, or Cr. Mixtures of the two carbides and each of the metals gave borides of the metals, titanium boride, and graphite.

CORROSION

1217

Los Alamos Scientific Lab.

ACCELERATED CORROSION TEST OF STEELS; by James T. Waber and Santon Waber. Apr. 1950. 27p. (LA-1313)

General tests have been made on materials being considered for duct work in the new CMR laboratories in an effort to determine which would be most satisfactory. Materials tested were "A" Nickel, "B" Monel, Inconel, Inconel B, and Types 316, 316 ELC, and 318 stainless steel. General accelerated corrosion tests were run in a simulated hood with the metals in contact with the fumes of six solutions—five concentrated acids and one alkali. The saw kerfs in each specimen were examined for stress corrosion. Welded specimens of the metals were also tested for stress corrosion cracking and for intergranular attack of the heat-affected areas. The stainless steels and Inconel showed the best resistance to general chemical attack. Inconel offers the additional feature of being free from stress corrosion susceptibility and pitting. Hence, it is preferable by more than a slight margin. In general, the results of these corrosion tests agree quite well with general commercial experience. The use of Inconel is recommended for the duct work because of the freedom from stress corrosion and pitting. Stress corrosion tests were run on seamless and welded stainless steel tubing in the standard magnesium chloride reagent. The samples cracked abundantly after a few hundred hours. Considerable protection was afforded by heat-treating the tubing at 1950°F for one-half hour and then air-cooling. Where stainless tubing is used for drains, the 1950°F heat-treatment is recommended. It is also desirable that the steel be pickled before being passivated. (auth)

1218

Naval Research Lab.

CORROSION OF BRASS-RETAINER BALL BEARINGS; by Hayward R. Baker. Dec. 20, 1951. 9p. (NRL-3918)

Difficulty has recently been experienced by bearing manufacturers, maintenance depots, and military laboratories from corrosion of steel balls and races during storage of brass-retainer ball bearings. This corrosion has been duplicated in the laboratory and has been shown to be galvanic in nature. The rate of corrosion is accelerated by small quantities of acids formed by oxidation of a petroleum or diester or by hydrolysis of an aliphatic diester oil. The rust inhibitor, barium mahogany sulfonate, serves to accelerate the rate of corrosion by its presence. This corrosion can be greatly reduced or even prevented by using a corrosion inhibitor capable of neutralizing the acids as they are formed and thus preventing them from accelerating the rate of corrosion between the dissimilar metals.

1219

A MECHANISM OF STRESS-CORROSION IN ALUMINIUM–MAGNESIUM ALLOYS. C. Edeleanu. J. Inst. Metals 80, 187-91(1951) Dec.

The attack on Al and Al-rich alloys, immersed in neutral chloride solutions, tends to become restricted to a limited area owing to the autocatalytic nature of the anodic reaction. On homogeneous alloys, corrosion causes scattered pits which can increase either in depth or in area; but in the case of alloys possessing a path of easy corrosion, the attack takes the form of trenching and is confined to the tips of the cracks so formed. This latter type of corrosion leads to great mechanical weakening, even though the actual rate of attack per unit area may not be very different in the two instances. The nature of the path of easy corrosion is unknown, but there is evidence that it is submicroscopic in width. No indication has been found that, in the case of Al–Mg alloys, it consists of the equilibrium second phase, β. From experiments carried out on Al–7% Mg alloy, it is concluded that stress exerts no influence during the first stages of the process (the greater part of the life), but that corrosion plays a vital role during the final rapid cracking. (auth)

GEOLOGY AND MINERALOGY

1220

Department of Mines and Technical Surveys (Canada)

EQUILIBRIUM ASSAYING OF URANIUM ORE; by John W. Hilborn. Dec. 1, 1951. 28p. (NP-3588; Topical Report 92/51)

A method is described for determining the U_3O_8 content of radioactive ores using the observed β and γ emissions even if the natural mass equilibrium of the uranium series has been disturbed. The calibration constants for the system are independent of differences in equilibrium among the chemically assayed standards used as a basis for calibration. The γ detector is a NaI(Tl) crystal in conjunction with a 5819 photomultiplier tube. The γ sensitivity is increased by a factor of 200 over a similar system using a γ-detecting Geiger tube, and the signal-to-background ratio improved by a factor of 60. The instrument accurately assays samples from 0.005 to 2% U_3O_8 in reasonable counting times. (auth)

1221

Columbia Univ.

PRELIMINARY MEMORANDUM OF A PORTION OF THE "BENNY K" CLAIMS, PIUTE COUNTY, UTAH; by Harry M. Dahl and Paul F. Kerr. Issued Nov. 6, 1951. 13p. (RMO-831)

Results of field studies in a portion of the "Benny K" Claims Area, Piute Co., Utah, are reported. Geology, structure, lithology, stratigraphy, and radiometric measurements are mapped and described, and a detailed account of the thermal alterations of the area and the occurrence of U mineralization is given.

1222

Columbia Univ.

PRELIMINARY MEMORANDUM, EAST SLOPE AREA MARYSVALE, UTAH; by Jack Green and Paul F. Kerr. Issued Nov. 6, 1951. 19p. (RMO-832)

Results are reported of field exploration on the East Slope Area, including the J. and L. Alunite Claims and the East Slope Uranium Claims, Piute Co., Utah. The area was mapped topographically using aerial photographs; stratigraphy, lithology, structural features, thermal alterations, and mineralizations of the area are described. A map showing alterations and radiometric determinations is included. The sequence of events responsible for the East Slope U deposition is described in detail. Field evidence indicates that hydrothermal alteration both preceded and followed eruption of the Mount Belknap volcanic series. It seems likely that alunite deposition was limited to the earlier period. U may have been formed during both periods of hydrothermal activity but the most suggestive evidence favors the later period.

1223

Columbia Univ.

PRELIMINARY MEMORANDUM, PAPSY'S HOPE PROS-

PECT MARYSVALE, UTAH; by Gerald P. Brophy and Paul F. Kerr. Issued Nov. 6, 1951. 13p. (RMO-833)

Results of field work are reported on Papsy's Hope Prospect, Piute Co., near Marysvale, Utah. Intrusive and extrusive rocks all of Tertiary age are present; stratigraphy, lithology, and structural features are described and mapped. Hydrothermal alterations are confined to the Bullion Canyon rocks and intrusive latite. Secondary U mineralization was confined to flow-type rocks of these strata that had undergone a degree of alteration defined as stage 3. The alteration channels evidently coincide with the pre-Belknap faults. The other flow rocks in the stratigraphic sequence may be mineralized along the alteration channels at depth. This appears to be a significant feature from the standpoint of exploration. An alteration map, a radiometric map, and a map showing U distribution in the prospect are given.

1224

Columbia Univ.

PRELIMINARY MEMORANDUM ON THE DARK HORSE AND SATURDAY AREAS, MARYSVALE, UTAH; by Louis E. Woolard and Paul F. Kerr. Issued Nov., 1951. 15p. (RMO-860)

The areas of the Dark Horse and the Saturday Claims near Marysvale, Piute Co., Utah, were explored. Stratigraphy, lithology, structural features, thermal alterations, and mineralizations of the areas are described and mapped. Topographic maps and the results of radiometric studies are given. The quartz monzonite intrusion in the Dark Horse Area shows similarities to the intrusive in the central mining area in texture and structure and in the fact that highs in radioactivity are limited to fractures and veins. In both areas NE and NW fractures are commonly altered; NS and EW less commonly. Possibly the Bullion Canyon nonbiotite porphyry has been thermally metamorphosed in the Saturday claims and can be used as an index of intrusive activity. Radioactive materials are present in the Saturday as well as the Dark Horse claims and may increase with depth. Abnormal surface erosion and leaching may yield radioactive counts that are subnormal in contrast to the Marysvale central area. Thus any appreciable count in this area may be more significant than it would be otherwise.

1225

ON THE SPONTANEOUS DESTRUCTION OF THE CRYSTALLINE LATTICE OF RADIOACTIVE MINERALS. Paul Pellas. Compt. rend. 233, 1369-71(1951) Nov. 26. (In French)

The effects of α rays and recoil nuclei on crystal lattices having either partially covalent or ionic bonds are discussed. The radiation flux in Th-U minerals is given by the following equation, in which the time of irradiation is taken into account and the destructive effect of recoil nuclei is considered to be 10 times that of α particles: $N = (4.25\ U + 1.21\ Th)\ K'\ T$, where N is the α-ray-equivalent flux emitted in a 4π solid angle by a 1-cm^2 layer of mineral, U and Th are the percentages of U and Th, T is the geologic age in seconds, and K' is an absorption coefficient equal to $0.85/\Sigma\ (Cs/A)$, where C is the concentration, s the stopping power, and A the atomic weight of the mineral constituents. The minimum flux intensities necessary to change the original anisotropic lattice to an optically amorphous lattice in allanite, fergusonite, and thorite are, respectively, $2.3(\pm 20\%) \times 10^{17}$, $4(\pm 20\%) \times 10^{17}$, and $1(\pm 10\%) \times 10^{19}\ \alpha/cm^2$.

METALS AND METALLURGY

1226

Ames Lab.

BEHAVIOR OF PLATINUM/PLATINUM-RHODIUM THERMOCOUPLES AT HIGH TEMPERATURES; by Harry J. Svec. Jan. 8, 1952. 2p. (AECU-1804)

In a recent communication R. C. Jewell and E. G. Knowles (J. Sci. Instruments 28, 353(1951)) describe their experience with the Pt/Pt, 13% Rh thermocouple at high temperatures. Contrary to the report of McQuillan (J. Sci. Instruments 26, 329(1949)) they find Rh to be preferentially volatilized. Similar observations have been made in these laboratories. The Pt/Pt-Rh thermocouples were used in vacuum furnaces at 1 to 50 μ Hg pressure in the temperature range 1500 to 1600°C for long periods of time. Thinning of the wires was observed with a concurrent drop in emf output of the thermocouple. Repeated calibrations of a "used" thermocouple at the melting point of Cu were employed to establish this fact. This drop in emf output of the couple continued until accidental breaking of the wires occurred. Chemical analysis indicated the drop in emf is due to a decrease in the Rh content of the 13% Rh alloy used in making up the couple. These couples were insulated with alundum or BeO, two-holed thermocouple insulators. It is interesting to note that when BeO insulation was used, erosion of the refractory took place at the hottest end of the thermocouple with crystals of pure Be metal condensing on the cooler portion of the insulator. Presumably at these high temperatures reaction between BeO, Rh, and Pt occurs from volatilization of the reaction products. When alundum insulation was used, erosion of the refractory was also observed but no attempts were made to identify reaction products, since in this case no definite crystalline condensates were found. These observations were made under different experimental conditions from those of Jewell and Knowles. However, it does approach their "actual practice" criterion. (Entire report)

1227

Atomic Energy Research Establishment, Harwell, Berks (England)

FORMATION AND POLARISATION OF ANODIC OXIDE FILMS ON TANTALUM ELECTRODES; by L. Young. Sept. 28, 1951. 17p. (AERE-M/R-790)

The thicknesses of anodic oxide films and the current efficiency in formation estimated in Report AERE-M/R-711 (NSA 5-5658) have been confirmed by weighing the films and also by estimating chemically the amount of O_2 liberated during formation. The variation of the current efficiency over the range 0.0004 to 20 ma/cm^2 has been investigated by determining the rate of rise of potential at a given current density and the field necessary to give this current density. Güntherschulze and Betz (Z. Physik 68, 145(1931); 73, 580(1932; 92, 367(1934)) found that the current efficiency rose with current density to a constant maximum value of about 40% at a few ma/cm^2. The values of dV/dQ and F giving this constant value have now been shown to correspond to nearly 100%. Comparatively high values were obtained at low current densities. The electronic current is partly associated with imperfections in the film. The data on current efficiency and field as functions of current enable the total current to be separated into ionic current (which leads to film growth) and electronic current (which does not). The ionic-current density i $\mu a/cm^2$ was found to obey the equation $i = \alpha e^{\beta F}$, where $\beta = 4.9 \times 10^{-6}$ cm/v and $\alpha = 1.67 \times 10^{-12}\ \mu a/cm^2$ up to a field $F \approx 7 \times 10^6$ v/cm, after which the current increases even more rapidly with field. The value of β gives a value of "a" in Mott's theory of 2.4 A.

1228

Atomic Energy Research Establishment, Harwell, Berks (England)

THE EXAMINATION OF METALS UNDER POLARISED LIGHT; PART IV. APPLICATION TO A STUDY OF

VARIOUS ANISOTROPIC METALS AND INTERMETALLIC PHASES; by B. W. Mott and H. R. Haines. Oct. 16, 1951. 29p. (AERE-M/R-791)

The application of polarized light to the micrometallurgical study of the anisotropic metals Sb, Be, Bi, Cd, Co, Mg, Sn, Ti, U, Zn, and Zr and the anisotropic constituents of Mn-U, Al-Th, Se-Th, and Al-U alloys, WC compacts, and martensitic steels is discussed. Details are included of the methods of preparation of each metal, both as described in the literature and as developed by the authors, and photographs are included to illustrate the results obtained. A tentative explanation of the observations made on mechanically polished specimens under polarized light is given in terms of the various possible surface layers produced during preparation. 34 figures.

1229

Bureau of Mines

ZIRCONIUM-TITANIUM SYSTEM; CONSTITUTION DIAGRAM AND PROPERTIES; by Earl T. Hayes, A. H. Roberson, and O. G. Paasche. November 1951. 21p. (BM-RI-4826)

The Zr-Ti system was investigated over the entire range of compositions from 100% Zr to 100% Ti using both graphite-melted and arc-melted alloys. Thermal analysis, resistivity measurements, melting-point studies, and x-ray analysis were used to determine the phase relationships. Zr and Ti are soluble in all proportions and form two series of solid solutions—the beta (cubic) form at elevated temperatures, and the alpha (hexagonal) form. The beta transformation point is depressed to a minimum at 50 at.% and 5350°C. The liquidus reaches a minimum at 67 at.% Zr and 1,610°C. Maximum strengths are developed in the 50 at. % composition in the hot-rolled, quenched, and annealed condition. Tensile strengths of 158,000 psi were found in the graphite melted alloys of this composition. The resistance of these alloys to high temperatures is extremely poor. The 50 at.% alloys decomposed to powder after being heated a few hours in air at 1,000°F. (auth)

1230

Jet Propulsion Lab., Calif. Inst. of Tech.

THE GAS PERMEABILITY OF SOME COMMERCIALLY AVAILABLE POROUS METALS; PROGRESS REPORT; by Pol Duwez. Aug. 8, 1947. 32p. (JPL-PR-1-67)

The results of experiments made on some commercially available porous metals in view of their use in sweat-cooling applications lead to the conclusion that the porosity and the permeability coefficient of the Porex bronzes and of the Chrysler bronzes of types 3, 4, 5, and 33 were quite consistent. Values of porosity and permeability for the Chrysler bronzes of types 2, 11, 22, 44, 55, and the Micro Metallic stainless-steel specimens were more or less scattered, indicating a poor control in fabrication. No systematic relation was found between porosity, permeability coefficient, and the structure of the different porous metals. (auth)

1231

Jet Propulsion Lab., Calif. Inst. of Tech.

PREPARATION AND PHYSICAL PROPERTIES OF POROUS IRON; PROGRESS REPORT; by Pol Duwez and H. E. Martens. Aug. 29, 1947. 50p. (JPL-PR-1-71)

The method of preparing porous metals by addition of ammonium bicarbonate to the compacts has been extended to three kinds of iron powder. The relation between porosity and amount of ammonium bicarbonate was about the same for the three kinds of powder. Specimens made with one of the three powders (MD-111) had, for a given porosity, either a greater tensile strength or a greater permeability than the specimens made with the two other powders. The physical properties of the MD-111 porous specimens covered the following ranges: porosity between 15 and 51%; ultimate strength between 24,000 and 5000 psi; and permeability coefficient between 0.4×10^{-10} and 14×10^{-10} in.^{2} (auth)

1232

Jet Propulsion Lab., Calif. Inst. of Tech.

THE PERMEABILITY OF POROUS IRON; PROGRESS REPORT; by Leon Green, Jr., and Pol Duwez. Feb. 9, 1949. 26p. (JPL-PR-4-85)

The results of the experimental study of the permeability of porous iron specimens lead to the conclusion that the flow of a gas through a porous metal can be described with sufficient accuracy by a quadratic equation relating the difference of the squares of the pressures on both sides of the metal to the weight rate of flow through it. This equation, which defines two resistance coefficients characterizing the metal structure (viscous resistance coefficient and inertial resistance coefficient), is valid over the entire range of flows tested, and reduces to Darcy's equation at very low flow rates. For a given metal powder and a given ammonium bicarbonate powder, the viscous resistance coefficient of a porous metal is inversely proportional to the porosity raised to a power of about 7. This porosity function is not greatly affected by the pore sizes within the limits of this investigation. For a given metal powder and a given ammonium bicarbonate powder, the inertial resistance coefficient of a porous metal decreases with increasing porosity. The relationship between these two variables was not evident as a result of this investigation. (auth)

1233

Jet Propulsion Lab., Calif. Inst. of Tech.

PREPARATION AND PHYSICAL PROPERTIES OF POROUS IRON-NICKEL ALLOY; PROGRESS REPORT; by Howard E. Martens. Mar. 4, 1949. 24p. (JPL-PR-4-93)

This report covers an investigation of the physical properties of an Fe-Ni alloy (80% Fe, 20% Ni) prepared by powder metallurgy methods. The porous specimens were prepared by mixing the Ni and Fe powders with various amounts of ammonium bicarbonate, compacting the mixture at pressures ranging from 40,000 to 100,000 psi, and sintering for 4 hours in an atmosphere of pure hydrogen. The tensile strength of the specimens after sintering varied from 70,000 to 14,000 psi for a variation in porosity from 15 to 47%. The modulus of elasticity varied from 18.5×10^6 to 6.0×10^6 psi, depending on the porosity. The endurance limit was also measured and was found to range from 15,000 psi for an alloy of 14% porosity to 5000 psi for an alloy of 30% porosity. (auth)

1234

Jet Propulsion Lab., Calif. Inst. of Tech.

A METHOD FOR MACHINING POROUS METALS; by H. L. Wheeler, Jr. Apr. 15, 1949. 8p. (JPL-PR-4-97)

Surface smearing or distortion of porous metals may be eliminated by filling the pores with a material such that the impregnated mass will machine like a solid piece of metal. Various filling techniques are discussed and the most satisfactory methods of machining impregnated porous metals are described. Photomicrographs of surfaces machined in various ways are shown and compared with photomicrographs of unimpregnated machined surfaces. It is shown that smearing is largely eliminated by this technique.

1235

Institute of Engineering Research, Univ. of Calif.

ON THE CORRELATION BETWEEN CREEP AND TENSILE PROPERTIES OF DILUTE ALPHA SOLID SOLUTIONS OF ALUMINUM; by Oleg D. Sherby and John E. Dorn. Nov. 15, 1951. 44p. (NP-3553)

Creep and tensile data of alpha solid-solution alloys of Al above 400°K are found by simply relating the Zener-Holloman relation $\sigma \equiv \sigma (\dot{\epsilon} e^{\Delta H/RT})$. In addition, the creep strains for a stated creep stress are plotted in terms of a temperature modified time, $\theta = te^{-\Delta H/RT}$, wherein a single creep curve is obtained independent of the test temperature. The activation energy, ΔH, is found to be a constant and equal to 35,800 calories per mole for all the solid-solution alloys investigated.

1236

Metals Corrosion Lab., Bureau of Mines

CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; MONTHLY REPORT FOR SEPTEMBER 1951; by L. B. Golden, D. Schlain, I. R. Lane, Jr., W. L. Acherman, and W. Mace. [nd] 8p. (NP-3568)

Results of corrosion studies are given for Ti, Zr, and Carpenter No. 20 stainless-steel corrosion by phosphoric acid aerated with He; Ti, Zr, stainless steels and Hastelloy C corrosion by Ca and Na hypochlorite; Ti-Zr alloys corrosion by Na, Ni, and Al chlorides; Ti-Pb couples galvanic corrosion in synthetic ocean water; Ti-metal couples corrosion in synthetic ocean water aerated with He; and Zr alloys corrosion by rocket fuels.

1237

Naval Research Lab.

SOLUBILITY OF OXYGEN IN POTASSIUM METAL AND SODIUM-POTASSIUM ALLOYS; by Dale D. Williams. Dec. 19, 1951. 18p. (NRL-3894)

The oxides resulting from the incomplete reaction of potassium metal and sodium-potassium alloys with dry oxygen have been isolated and identified as the monoxides of potassium and sodium, respectively. The equilibrium oxide in a sodium-potassium-oxygen system is sodium monoxide exclusively.

The solubility of potassium monoxide in potassium has been determined and is expressed by Wt. % $O_2 = 0.0865 - 0.0006089t + 0.000007714t^2$ where t equals °C for the range 65-310°C. The solubility of sodium monoxide in potassium and in sodium-potassium alloys has been determined and is expressed by Wt. % $O_2 = 0.0012 - 0.00000871t + 0.000000128t^2$ where t equals °C for the range 50-360°C. Potassium metal may be freed of its oxide by distillation or by reaction with a quantity of sodium metal equivalent to its oxide content followed by filtration.

1238

[Columbia Univ. School of Mines]

THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS; PROGRESS REPORT FOR SEPTEMBER 1 TO NOVEMBER 31, 1951; by T. A. Read, L. C. Chang, M. W. Burkart, D. S. Lieberman, S. Zirinsky, J. Intrater, R. Bakish, and M. Wechsler. [nd] 5p. (NYO-934)

Applied shear stress produced a linear shift of the two transformation temperatures of Au−47 at. % Cd alloys without changing the difference between them. The latent heat of transformation has been calculated as 0.40 cal/g. A multivalued dependence of elastic properties on temperature in the region 100 to 275°C with single-valued dependence above 275°C was found. The martensitic transformation in Cu-Sn alloys was established as extending from 22.0 to 26.5% Sn. The increase in Sn content lowers the Ms point from about 130 to about −150°C. Alloys of 22.0 to 23.5% Sn content have martensitic structure on quenching in 10% NaOH at room temperature, but not on oil quenching above 100°C, which gives structure stable even on cooling to liquid N_2 temperature. The β phase preserved by room-temperature 10% NaOH quenching undergoes reversible transformation only once on cooling and then becomes stabilized. The transformation interface between fcc and tetragonal structures in a single crystal of In-20.75% Tl always was found on a (110) plane of the crystal; any combination of these planes being a possible cycle. Two-interface transformation also was observed. Either transformation was marked by a sudden decrease in length under small axial compressive load. The transformation temperature was 72°C on heating and 65°C on cooling and was raised by increasing the load.

1239

General Electric Research Lab.

FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; TWELFTH QUARTERLY REPORT; by J. H. Hollomon and D. Turnbull. Jan. 5, 1952. 10p. (SO-2019; Progress Report No. 29; RL-639)

Brief statements only are made of progress on the following problems: Data to be published on measurement of the self-diffusion of liquid Hg in the range 0 to 90°C using a capillary tracer technique may be represented by the equation $D = 1.26 \times 10^{-4} \exp(-1160/RT)$. The capillary technique will be adapted for high-temperature use in the measurement of the self-diffusion in liquid Ag. Grain-boundary self-diffusion in bicrystals of Ag is being measured by a radioautographic technique. Activity coefficients in the Fe-Ni, Co-Pt, and Cu-Au systems are being determined. Measurements of specific heats and other thermodynamic functions of diamond from 14 to 300°K are now being evaluated. The activation energy for the flow of electric current in high-purity graphite has been found to be very low ($\Delta E \simeq 0$) at temperatures below 35°K. In the temperature region 150 to 290°K the increase in resistivity is approximately exponential with an activation energy $\Delta E = 1.6 \times 10^{-4}$ ev. Resistivity and thermoelectric-power studies are under way on a Te-Bi alloy. Vapor pressures of alkali halides as low as 10^{-13} mm Hg are to be measured by flashing the alkali ions from a filament and measuring the charge ballistically; the surface energy of NaCl is to be determined by this method.

1240

INFLUENCE OF MICROSTRUCTURE ON CREEP RESISTANCE. Georges Delbart and Michael Ravery. Metal Progress 60, No. 6, 62-8(1951) Dec.

Experiments have been performed to study the relationship between creep resistance and microstructure of a Cr-Mo steel having the following analysis: 0.12% C, 0.02% P, 0.01% S, 0.16% Si, 0.7% Mn, 0.6% Cr, 0.65% Mo, 0.03% Al, and <0.010% Ti. This steel, after the usual hot work, was heat-treated in nine different ways to as many different microstructures. A wide variety of creep rates at the same temperature and load was noted. A deduction from short-time tests is that the creep rate at lower temperatures (450 to 525°C) decreases as the structure changes from granular ferritic to sorbitic to bainitic. At the higher temperatures, 550 and 575°C, and at rather heavy stress, the sorbitic structures flow more rapidly than the bainitic or ferritic-bainitic structure. Long-time creep tests (1000 hr) were also made at 450 and 575°C. Under low stress the annealed structures (granular ferrites) are the more resistant, but with heavier loadings they lose their superiority, thus reaffirming the double influence of temperature and stress on any appraisal of a particular microstructure. Likewise, these annealed structures have higher creep rates at 1000 hr than at 300 hr. The effect of reheating specimens to 450, 575, or 700°C was also studied.

1241

HIGH PURITY ZIRCONIUM METAL. F. B. Litton. Metal Progress 60, No. 6, 83-6(1951) Dec.

A total of 7.35 lb relatively pure (~99.9%) Zr was produced for determination of basic physical properties. In

comparing the average content of each of the major metallic impurities in iodide-refined Zr with the analysis of crude Zr starting material, it was noted that iodide refinement reduced Si, Al, Mg, Fe, Ti, and Ca substantially, but there was no reduction in Ni and Hf. The work-hardening curves for iodide and arc-melted iodide Zr were similar, except that maximum hardnesses were attained at ~70 and ~60% cold reduction, respectively. The maximum hardness was Rockwell A-52 for both materials after 90% cold reduction. The penetration of O_2 into Zr at 1020, 1380, and 1740°F was determined for 2-hr heating periods in still air. Hardness measurements showed that ~0.35-mm penetration occurred at 1380 and 1740°F. The hardness of iodide Zr was Rockwell A-20.9 ± 6.7 (Vickers 90 ± 17). Minimum value was Rockwell A-9.5 (Vickers 72).

1242

ANNEALING TEXTURES IN ROLLED FACE-CENTERED CUBIC METALS. Paul A. Beck and Hsun Hu. J. Metals (N.Y.) 4, 83-90(1952) Jan.

As described by means of quantitative pole figures, the annealing texture of highly rolled Al consists of the four retained components of the rolling texture near (123) [1$\bar{2}$1], rather more sharply developed, and of a cube texture component. Local reorientation corresponds fairly well to 40° rotation around a [111] axis. Microscopic study of the annealing process in 95%-rolled, large-grained, high-purity Al by means of the oxide-film and sensitive tint-illumination technique shows that the retainment of the rolling texture is a result of both recrystallization in situ and recrystallization with local reorientation, where the orientation of the recrystallized grains is different from that of their local surroundings, but it is similar to an orientation prevalent in the rolling texture as a whole. In Cu strip rolled 96% the annealing texture is mainly the cube texture, with the four twin orientations as minor components. The annealing texture of highly rolled brass strip consists of four components of the (225) [7$\bar{4}$4] type.

1243

CRYSTAL STRUCTURE OF TiAl. Pol Duwez and Jack L. Taylor. J. Metals (N.Y.) 4, 70-1(1952) Jan.

The crystal structure of an intermediate phase of varying composition in the Al-Ti system was studied by x-ray-diffraction techniques. The crystal structure of TiAl is tetragonal, type LI_0 (AuCu ordered). At 750°C the TiAl phase extends from 46 to 62 at. % Al. Within this range the a parameter decreases and the c parameter increases with increasing Al concentration. The axial ratio c/a increases regularly from 1.017 to 1.026. Diffraction data for the 55-at. %−Al alloy are tabulated.

1244

ON THE SOLUTION OF DIFFUSION PROBLEMS INVOLVING CONCENTRATION-DEPENDENT DIFFUSION COEFFICIENTS. Carl Wagner. J. Metals (N.Y.) 4, 91-6(1952) Jan.

A solution for the concentration distribution in diffusion couples is presented for the case where the diffusion coefficient is an exponential function of the concentration of one of the components of a binary alloy. A solution has been worked out for diffusion of an alloying element to or from the surface of a sample, if the diffusion coefficient is an exponential function of the concentration. On the basis of a paper by Hartley and Crank (Trans. Faraday Soc. 45, 801(1949)), definitions of modified coordinate systems are given in order to obtain the conventional generalized form of Fick's second law if an alloy cannot be regarded as a rigid framework. (auth)

1245

ROLLING TEXTURES IN FACE-CENTERED CUBIC METALS. Hsun Hu, P. R. Sperry, and Paul A. Beck. J. Metals (N.Y.) 4, 76-81(1952) Jan.

As described by means of quantitative pole figures, the inside texture of highly rolled Al and Cu strips may be approximately described by four equivalent ideal orientations near (123) [121]. If rolled in reversed passes, the surface texture of Cu is also near (123) [121]; that of Al is (100) [011]. The inside texture of highly rolled brass is (110) [1$\bar{1}$2]. The surface texture is the same, if rolled in reversed passes. The surface texture of all three metals is related to the inside texture, but asymmetrical, if rolled without reversal between passes. (auth)

1246

THE SIGMA PHASE IN BINARY ALLOYS OF THE TRANSITION ELEMENTS. A. H. Sully. J. Inst. Metals 80, 173-9 (1951) Dec.

The appearance of the σ phase in alloys of elements of the first long period can be satisfactorily accounted for if it is assumed that the incidence of this phase is determined by a critical excess of electrons in bond orbitals over vacancies in the 3d atomic orbitals. In the alloys of Co and Fe with Cr; Fe, Ni, and Co with V; and Cr and V with Mn, predictions of the boundary of the homogeneous σ-phase region can be made on the basis of this hypothesis which accord well with experimental data where these are available. The fact that the σ field does not include the equiatomic composition in certain alloy systems is also explained. It is probable that σ phases occur in alloys between transition elements of the other long periods. (auth)

1247

THE STRUCTURE AND SOME PROPERTIES OF TITANIUM-OXYGEN ALLOYS CONTAINING 0-5 AT.-% OXYGEN. A. E. Jenkins and H. W. Worner. J. Inst. Metals 80, 157-66(1951) Dec.

By means of measurements of thermoelectric power at various temperatures and by quenching experiments on alloys made with refined Ti, the limits of the ($\alpha + \beta$) region up to 5 at. % oxygen have been established. Alloys based on commercially pure Ti have also been studied, and it has been demonstrated that the impurities present in the commercial grade of metal cause a marked broadening of the $\alpha \rightleftharpoons \beta$ transformation range. The mechanical working and annealing of commercially pure alloys have been examined, and it has proved possible to develop techniques for forging and swaging alloys containing as much as 3.5 at. % oxygen. Alloys containing more than 1.5 at. % oxygen may be hot worked, but they are more or less brittle at normal temperatures. Special attention has been given to some of the main factors affecting the cold drawing and annealing of alloy wires. The proof stress, nominal ultimate stress, plastic elongation, and hardness of annealed alloys have been determined, chiefly with a view to providing some quantitative concept of the variation of these mechanical properties with oxygen content. (auth)

1248

SOME METALLOGRAPHIC OBSERVATIONS ON THE FATIGUE OF METALS. P. J. E. Forsyth. J. Inst. Metals 80, 181-6(1951) Dec.

A metallographic investigation of the effects of cyclic stresses on the microstructure of an Al−½% Ag alloy has shown that factors other than simple slip are involved in the mechanism of fatigue at room temperature. There is evidence of a recovery process associated with the formation of deformation bands and crystallites during fatiguing of the metal, and it is suggested that the observed anomalies in the effect of stress concentration on crack progress are the result of crystallite formation at the roots of the cracks. (auth)

1249

CRYSTAL STRUCTURE OF $TaCr_2$ AND $CbCr_2$. Pol Duwez and Howard Martens. J. Metals (N.Y.) 4, 72-4(1952) Jan.

In the Ta-Cr and Cb-Cr systems, the only intermediate phase is located around the stoichiometric compositions $TaCr_2$ or $CbCr_2$. The crystal structure of $CbCr_2$ is face-centered cubic, $MgCu_2$ type, with 24 atoms per unit cell. The $TaCr_2$ phase has a polymorphic transformation at a temperature between 1375 and 1590°C. The low temperature form is isomorphous with $CbCr_2$ ($MgCu_2$ type). The high temperature form is hexagonal, $MgZn_2$ type, with 12 atoms per unit cell. (auth)

1250

A SIMPLE METHOD OF X-RAY MICROSCOPY AND ITS APPLICATION TO THE STUDY OF DEFORMED METALS. R. W. K. Honeycombe. J. Inst. Metals 80, 39-44(1951) Sept.

A method of obtaining images from metal crystals, using a line source of characteristic x rays, is described. The images can be enlarged to at least 50 diameters to reveal significant microscopic phenomena, in particular distortions arising from slight plastic deformation which are not readily observed by optical micrography. However, optical micrography is of great assistance in the initial interpretation of the x-ray images, and the two techniques should be regarded as complementary. The scope of the method in the study of plastic deformation is illustrated by a series of x-ray and optical micrographs obtained from metal crystals deformed under varying conditions. (auth)

1251

EFFECT OF PRESSURE ON THE REFINING OF LITHIUM BY DISTILLATION. R. R. Rogers and G. E. Viens. J. Electrochem. Soc. 98, 483-7(1951) Dec.

The experiments described show that Li containing 0.5% Na can be refined by distillation in the presence of A in a straight retort, the refined material containing as low as 0.002% Na. At gauge pressures up to 1 μ the Na content differs very little from this value. In increasing the pressure from 1 to 740 μ the Na content is quadrupled. In the presence of A, N, O, and H at different pressures in a slightly V-shaped retort, a Na-content of less than 0.01% was not obtained. There was little or no evidence of oxide, nitride, or hydride formation at pressures of O, N, or H below 35 μ. (auth)

1252

SOME OBSERVATIONS ON THE OCCURRENCE OF STRETCHER-STRAIN MARKINGS IN AN ALUMINIUM–MAGNESIUM ALLOY. R. Chadwick and W. H. L. Hooper. J. Inst. Metals 80, 17-22(1951) Sept.

Detailed observations have been made of the appearance of and dimensional distortion associated with surface markings developed by the progressive stretching of Al–3% Mg alloy sheet in different conditions of cold working and annealing. In material of 0.025 mm grain-size, markings develop with a very small strain and are at first normal to the tension axis but subsequently become random in direction, reaching maximum intensity at about 1%, and decaying within a 2% extension. These random markings consist of a series of kinks, and there is no thinning of the sheet. Parallel, intersecting bands or shallow grooves at a definite angle to the direction of stretching first appear at about 2% extension and increase progressively in intensity up to the point of fracture. Parallel bands, which are caused by local thinning or necking, are of much less intensity than the random markings, which are the main cause of defects in pressing operations.

When the grain-size exceeds 0.05 mm, random markings do not occur in stretching, nor are they obtained in partially annealed or temper-rolled sheet irrespective of grain-size. Parallel bands are found in all these materials. When the grain-size is increased substantially, the well-known "orange-peel" effect develops on stretching and completely masks any other effect which might be present, the degree of roughening from this cause in sheet of 1.0-mm grain-size being comparable with that produced by random markings in fine-grained sheet. (auth)

1253

THE GRAIN REFINEMENT OF ALUMINIUM ALLOY CASTINGS BY ADDITIONS OF TITANIUM AND BORON. A. Cibula. J. Inst. Metals 80, 1-16(1951) Sept.

Previous work showed that the grain refinement produced by the addition of Ti or B to Al casting alloys is primarily caused by nucleating particles in the melts; the nuclei in Ti-containing alloys were found to be Ti carbide crystals, though only a small proportion of the added Ti was present in this form. The main objects of the present work were to identify the nuclei in other fine-grained Al alloys and to find ways of increasing the proportion of the refining elements present as nucleating compounds.

By centrifuging the particles from molten alloys containing B but no Ti and observing the change in grain-size produced, evidence was obtained that the nuclei in these alloys are aluminum boride crystals. The minimum B addition for adequate refinement of these alloys therefore depends mainly on the solubility of Al boride in molten Al.

Attempts to increase the concentration of Ti carbide in alloys containing Ti achieved no useful results, owing to difficulties in forming or dispersing the carbide as fine particles. The addition of B instead of C was more effective in producing refinement, nucleating particles of Ti boride being formed at very low concentrations of Ti and B; moreover, B was more easily added than C, as Al–B master alloys could be used. The boride formed was isomorphous with pure TiB_2, but had slightly different lattice dimensions and a range of composition (a_0 = 3.010 – 3.016 A, c_0 = 3.235 – 3.240 A).

The grain refinement of some commercial casting alloys by simultaneous additions of Ti and B was studied in detail; grain coarsening due to high casting temperatures, repeated remelting, or gravity segregation during solidification was less than in alloys containing much larger percentages of Ti alone. Alternative methods of adding Ti and B and the refinement produced by borides of transition metals other than Ti were investigated.

As the B additions required when Ti was present were small, the mold reaction previously encountered in alloys of high B content was largely avoided. (auth)

1254

INHOMOGENEITIES IN THE PLASTIC DEFORMATION OF METAL CRYSTALS. I. OCCURRENCE OF X-RAY ASTERISMS. R. W. K. Honeycombe. J. Inst. Metals 80, 45-9(1951) Oct.

A study has been made of the occurrence of x-ray asterisms from deformed single crystals of a typical hexagonal metal (Cd) and a typical cubic metal (Al). Cd can be extended by more than 100% elongation in tension without the appearance of asterisms in x-ray Laue photographs; asterisms occur only when the crystals are macroscopically bent or kinked. On the other hand, they are present in photographs from Al crystals after less than 4% elongation in tension. These asterisms contain intensity maxima which are shown to be a direct consequence of the deformation and not of a secondary phenomenon such as polygonization. On annealing, extended Cd crystals give sharp Laue spots, and the bent crystals polygonize very uniformly at 300°C. The appearance of asterisms from lightly extended Al crystals is unaltered by annealing at 250°C, at which temperature partial recovery of the yield stress occurs; but when the temperature is raised to 475°C the asterisms become further fragmented as a result of polygonization. These experiments suggest that tensile deformation causes Al, but not Cd, crystals to break down into a series of

slightly disoriented blocks connected by regions of distortion or lattice curvature. (auth)

1255
INHOMOGENEITIES IN THE PLASTIC DEFORMATION OF METAL CRYSTALS. II. X-RAY AND OPTICAL MICROGRAPHY OF ALUMINIUM. R. W. K. Honeycombe. J. Inst. Metals 80, 49-56(1951) Oct.

A technique of x-ray microscopy is used in conjunction with optical micrography to investigate the structure of large Al crystals deformed by small amounts in tension. Two types of microscopic inhomogeneity which cause local variations in orientation are described. First, there are narrow regions of curvature or kink bands separating slightly disoriented lamellae of the crystal; these bands occur initially on (110) planes, the normal to which coincides with the active slip direction. The second type of inhomogeneity comprises bands of secondary slip, which are regions nearly devoid of primary slip traces, in which slip on another system occurs preferentially. These bands are almost parallel to the primary slip planes in the early stages of deformation. The effects of crystal orientation, temperature and speed of deformation, and purity of metal on the occurrence of kink bands are investigated, and it is found that these are usually present after deformation, except when this occurs from the beginning by conjugate slip. Bands of secondary slip also generally occur, and in crystals deforming by conjugate slip, they are often of macroscopic size. The inhomogeneities play an important role in the deformation of Al and account for many of the differences between this metal and Cd, such as the occurrence of x-ray asterisms, the marked differences in strain-hardening, and the extent to which recovery can occur on annealing. (auth)

1256
THE ALLOYS OF MOLYBDENUM AND TANTALUM. G. A. Geach and D. Summers-Smith. J. Inst. Metals 80, 143-6(1951) Nov.

An investigation of the binary system Mo–Ta has shown that these metals form a continuous series of solid solutions. This is to be expected on theoretical grounds, as both metals crystallize with a body-centered cubic structure and the atoms are very similar in size. No superlattice was detected, and no anomalies occur between the true and x-ray densities. Approximate melting points of the alloys have also been determined. The alloys of the transition metals of groups IVA, VA, and VIA with each other are discussed briefly. (auth)

1257
EXPERIMENTS ON THE REACTION OF ALUMINIUM–MAGNESIUM ALLOYS WITH STEAM. A. J. Swain. J. Inst. Metals 80, 125-30(1951) Nov.

The reaction of Al–Mg alloys containing up to 25% Mg with pure steam has been investigated over a range of temperatures from 450 to 700°C. A maximum reactivity, dependent on the composition, was found at temperatures between 550 and 625°C. The significance of these results in relation to metal/mold reaction in the Al–10% Mg alloy is discussed briefly. (auth)

1258
SLIP BANDS AND HARDENING PROCESSES IN ALUMINIUM. A. F. Brown. J. Inst. Metals 80, 115-24(1951) Nov.

Slip bands on Al increase in number during plastic deformation and, at the same time, further slip occurs within each band. At higher temperatures and lower rates of deformation, as well as with increasing strain under all conditions, the latter process becomes increasingly predominant. This is interpreted on the basis of the fine structure of slip bands which has been resolved by the electron microscope. The differences in density and inner structure of slip bands formed under different conditions are compared with the differences between stress/strain curves, and it is shown that slip which forms a new band involves much more macroscopic hardening than slip within an existing band. A consequence of this conclusion is that a mechanical equation of state can exist only at very small strains. (auth)

1259
HIGH-TEMPERATURE THERMAL ANALYSIS USING THE TUNGSTEN/MOLYBDENUM THERMOCOUPLE. H. T. Greenaway, S. T. M. Johnstone, and Marion K. McQuillan. J. Inst. Metals 80, 109-14(1951) Nov.

A technique which enables thermal analysis to be carried out at temperatures up to 2000°C has been developed. High-frequency induction heating is used, and the temperature is measured by means of a tungsten/molybdenum thermocouple, for which a calibration curve is given. The method has been applied to the determination of the freezing point of pure Cr, which is shown to be 1845 ± 10°C, and the liquidus curve for the solid solution of Mn in Cr. (auth)

PHYSICS

1260
Argonne National Lab.
THE ELECTRICAL CONDUCTIVITIES OF NATURAL GRAPHITE CRYSTALS (abstract); by W. Primak and L. Fuchs. Nov. 23, 1951. 1p. (AECU-1809; UAC-468)

General agreement exists in the literature concerning the value of the "a" axis conductivity of graphite. However, measurements and estimates of the "c" to "a" axis conductivity ratio ranging from 10^{-2} to 10^{-5} have been reported. Graphite crystals (which are somewhat imperfect) have been separated from graphite-bearing crystalline limestones from northeastern North America. Measurements of potential drops and potential distributions on the surfaces of these graphite crystals carrying electric current show their "c" to "a" axis conductivity ratio to be approximately 10^{-2}, and in no case less than 1.7×10^{-3}. (Entire report. Abstract of paper for Columbus meeting of American Physical Society, Mar., 1952.)

1261
Oak Ridge National Lab.
UNDERLYING CONCEPTS OF NUCLEAR PHYSICS, p.84-151 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Arthur H. Snell. Dec. 1951. (TID-5031(p.84-151))

The underlying concepts of nuclear physics are explained in lectures entitled Stable Nuclei and Nuclear Reactions, Radioactivity, Neutrons, and Fission. The four lectures led to the statement of the conditions under which a chain reaction can take place in which neutrons are the active intermediaries.

1262
ON LINE WIDTH AND HYPERFINE STRUCTURE IN X-RAY SPECTRA. Daniel Curie. Compt. rend. 233, 1351-3(1951) Nov. 26. (In French)

The theory of the width of x-ray emission lines is reconsidered for the case where the separation of two levels is less than their width. The width of K rays calculated by the usual hydrogen-like model is too small by a factor of 2.

1263
IONIZATION POTENTIALS AND PROBABILITIES USING A MASS SPECTROMETER. R. E. Fox, W. M. Hickam, T. Kjeldaas, Jr., and D. J. Grove. Phys. Rev. 84, 859-60 (1951) Nov. 15.

A method for determining ionization potentials and ionization probability curves has been devised which eliminates the difficulties arising from uncertainties in the energy of the bombarding electrons. An electrode placed between the filament and the ionization chamber is maintained at a negative potential V_R with respect to the filament to prevent low-energy electrons from entering the chamber. The increase in the ion current observed when the absolute value of V_R is decreased by ΔV_R represents the ion current produced by a beam of electrons monoenergetic within ΔV_R. A small electric field is applied across the ionization chamber in a direction normal to the ion beam, but the electron current and the ion-draw-out voltage are given a pulsed time dependence to eliminate uncertainty in the electron energy. Ionization probability curves for $(A^{40})^+$ are shown.

1264
THE CHANGE IN ELECTRICAL RESISTANCE OF MAGNESIUM ON MELTING. F. Hubbard Horn. Phys. Rev. 84, 855-6(1951) Nov. 15.

The change in electrical resistance of Mg on melting has been determined for spectrographically pure and for commercially pure samples. The ratio of resistivity of the liquid to that of the solid is 1.63 for the spectrographic material. The temperature coefficient of resistivity for molten Mg is extremely small. The resistivity departs from a linear temperature dependence 20 to 30° before the melting point is reached. Diagrams of the cell construction and assembled apparatus are shown.

COSMIC RADIATION

1265
USE OF RADIO LIAISON IN THE STUDY OF COINCIDENCES BETWEEN PULSES ORIGINATING IN COUNTERS SEPARATED BY GREAT DISTANCES. E. Picard, A. Rogozinski, and M. Surdin. J. phys. radium 12, 854-9(1951) Nov.

Wireless radio circuits used in coincidence selection between widely separated counters discharged by very extensive cosmic-ray showers are described. Two types of transmitters are used: one of 5-Mc frequency and one of 10,000-Mc (for line-of-sight transmission up to 20 km). The first results obtained show true coincidences between stations 600 m and 1 km distant.

1266
A SEARCH FOR A DIURNAL VARIATION IN THE RATE OF STAR FORMATION. G. W. Anderson and J. E. Naugle. Phys. Rev. , 864(1951) Nov. 15.

The rate of formation of stars with ≥ 3 gray tracks has been measured at night and during the day in Ilford G-5 nuclear research emulsions at balloon altitudes. The corrected integral prong spectrum shows the characteristic break at $N_T \cong 8$. Evidence was obtained for a transition effect with respect to altitude in the rate of formation of stars with 3, 4, or 5 prongs. Within the statistical errors no change appears from day to night in either the magnitude of the rates or the shape of the prong spectrum. Rates for proton- and neutron-induced stars have also been calculated separately; they also show rough constancy from day to night.

1267
NUCLEAR DISINTEGRATIONS CAUSED BY FAST COSMIC-RAY NEUTRONS IN PHOTOGRAPHIC EMULSIONS. J. Pernegr. Nature 168, 1005(1951) Dec. 8.

A detailed analysis of 600 stars and 3000 single tracks in nuclear emulsions which had been exposed to cosmic radiation has been carried out. The measurements support the assumption that the single tracks are caused mainly by fast neutrons in glancing collision with the nuclei of the emulsion. The great majority of the stars are also caused by fast neutrons in glancing collision without capture of the incident neutrons in the nuclei.

1268
EFFECTS OF THE ATMOSPHERE ON THE PENETRATING COMPONENT OF THE COSMIC RADIATION. E. S. Cotton and H. O. Curtis. Phys. Rev. 84, 840(1951) Nov. 15.

Measurements made on the penetrating component of cosmic radiation near sea level for a period of 45 days have been utilized for statistical correlation with data on temperature and height of the 100-millibar level and the mean barometric pressure as recorded by nearby weather-bureau stations. The measuring equipment consisted of three trays of G-M tubes mounted as a vertical telescope. A linear regression equation was hypothesized, and numerical coefficients were computed. It was found that the correlation of the counting rate with the pressure and height is significant, while that with the temperature is not. By assuming exponential absorption of the radiation, a mean absorption thickness of 1160g/cm^2 was found.

1269
TRANSITION EFFECT OF THE STAR-PRODUCING RADIATION. L. Tomášková. Nature 168, 1005(1951) Dec. 8.

An experiment has been performed to prove the existence of the transition effect of the star-producing radiation. Ilford C2 plates were exposed at an altitude of 2640 m, one plate being under no absorber and the others being under Pb absorbers of thickness 1 to 5 cm. Comparison of the experimental values with the postulated exponential absorption curve shows a well-pronounced maximum of the frequency of stars under a layer of ~20 g/cm^2 Pb.

1270
ELECTRON-NUCLEAR SHOWERS AND THE NUCLEAR CASCADE PROCESS. N. G. Birger and I. L. Rozental. Uspekhi Fiz. Nauk 45, 104-12(1951) Sept. (In Russian; cf. NSA 4-2007 and 5-150)

Electron-nuclear cosmic-ray showers are discussed in relation to μ-meson decay and are compared with extensive air showers. 32 references.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1271
THEORETICAL ASSUMPTIONS IN THE EXPLANATION OF THE Pr IV SPECTRUM. Eleonore Trefftz. Z. Physik 130, No. 4, 561-4(1951). (In German)

The explanation by Hellwege (Z. Physik 130, 549-60(1951)) of the Pr IV absorption spectrum in crystals is shown to be not in disagreement with the theory of atomic energy levels.

1272
SPLITTING OF THE Pr^{+++} TERMS IN TRIGONAL SINGLE CRYSTALS OF PRASEODYMIUM ZINC NITRATE AND PRASEODYMIUM MAGNESIUM NITRATE. A. M. Hellwege and K. H. Hellwege. Z. Physik 130, No. 4, 549-60(1951). (In German)

The visible portion of the absorption spectra of $Pr_2Zn_3(NO_3)_{12}\cdot 24H_2O$ and $Pr_2Mg_3(NO_3)_{12}\cdot 24H_2O$ have been studied at 20 and 58°K with polarized light and high dispersion. The three deepest splittings of the ground term $^3H_4$ and all splittings of the terms $^3P_{0,1,2}$ and $^1D_2$ may be explained by an electric crystal field of C_3 symmetry. The crystal quantum number μ of the term components and the matrix elements of the electric crystal field have been determined. The local field of the Pr^{+3} ion is more intense in the Zn salt than in the isomorphous Mg salt.

1273
METHODS AND APPLICATION OF ELECTRON DIFFRACTION IN INDUSTRIAL RESEARCH. Adrian Stahl. Z. angew. Physik 3, 349-60, 382-96(1951) Sept., Oct. (In German)

Techniques, principles, and applications to the study of thin films, corrosion phenomena, catalysis, etc., of electron diffraction are reviewed. 552 references.

ELECTRICAL DISCHARGE

1274
SELF-MAGNETIC FIELD IN HIGH CURRENT DISCHARGES. M. Blackman. Proc. Phys. Soc. (London) 64B, 1039-45(1951) Dec. 1.

The theory of the self-magnetic field in high current discharges, originally developed by Tonks, has been investigated omitting a special assumption used in the work of Tonks. The influence of the parameters describing the discharge conditions has been considered in some detail. A comparison is also made with a simple, though more approximate, version of the theory due to Thonemann and Cowhig (Proc. Phys. Soc. (London) 64B, (1951)). The two theories are shown to be in good agreement. (auth)

GASES

1275
ISOTHERMS AND THERMODYNAMICAL FUNCTIONS OF THREE HYDROGEN-NITROGEN-AMMONIA MIXTURES BETWEEN 0 AND 150°C AND PRESSURES UP TO 300 ATMOSPHERES. A. Michels, T. Wassenaar, G. J. Wolkers, W. De Graaf, and P. Louwerse. Applied Sci. Research (Netherlands) A3, 1-10(1951).

Compressibility isotherms of three hydrogen-nitrogen-ammonia mixtures have been measured between 0 and 150°C up to densities of 180 Amagat (pressures up to 300 atmospheres). From these data thermodynamical functions have been calculated; they are given as functions of temperature and pressure. (auth)

1276
THE GRAVITATIONAL INSTABILITY OF AN INFINITE HOMOGENEOUS TURBULENT MEDIUM. S. Chandrasekhar. Proc. Roy. Soc. 210A, 26-9(1951) Dec. 7.

Jeans's analysis of the problem of the gravitational stability of an infinite homogeneous medium is examined and the need for including turbulence in the discussion is pointed out. The subject is then reconsidered from the point of view of the modern theories of turbulence, and it is shown how eddies in the density fluctuations which have wave numbers $k < \sqrt{4\pi G\bar{\rho}/(c^2 + \frac{1}{3}\overline{u^2})}$ (where c denotes the velocity of sound and $\overline{u^2}$ the mean square velocity of turbulence) are unstable in the sense that these fluctuations will grow with time. (auth)

1277
THE FLUCTUATIONS OF DENSITY IN ISOTROPIC TURBULENCE. S. Chandrasekhar. Proc. Roy. Soc. (London) 210A, 18-25(1951) Dec. 7.

The fluctuations of density in a compressible fluid under conditions of homogeneous isotropic turbulence are considered. It is shown how, from the equation of continuity alone, an invariant can be derived. Thus, if $\omega(r, t) = \delta\rho\delta\rho'$ denotes the correlation between the instantaneous fluctuations of the density from the mean, at two points separated by a distance r, then $\int_0^\infty r^2\omega(r, t)\, dr$ = constant. The meaning of this invariant is that the largest scales of the fluctuations of density are determined by the initial conditions of the problem and represent permanent features of the system. An equation of motion for $\omega(r, t)$ is also derived which relates the fluctuations in density with the fluctuations in velocity; if, as an approximation, we substitute in this equation of motion the expression for the fundamental correlation tensor $\overline{u_i u_j'}$ which is valid for an incompressible fluid, we obtain a simple equation connecting ω and the defining scalar, Q, of $\overline{u_i u_j'}$. When $\overline{u^2} \ll c^2$ (where c denotes the velocity of sound) the equation for ω is of the same form as that governing the propagation of spherical sound waves except that the velocity of propagation is not c but $\sqrt{2}c$. More generally, it is found that when the term in Q is included, the equation for ω still admits periodic solutions of the form of spherical waves; but they are distorted for small values of r and are propagated with a velocity $(2c^2 + \frac{2}{3}\overline{u^2})^{\frac{1}{2}}$. Also, under the same conditions we can picture $\omega(r, t)$ as a superposition of the fundamental periodic solutions. (auth)

INSTRUMENTS

1278
Mound Lab.
REPORT FOR GENERAL RESEARCH; JULY 30, 1951, TO OCTOBER 29, 1951; by M. M. Haring, Director. Dec. 3, 1951. 24p. (MLM-630)

Complete performance data are given for the high-gain, wide-dynamic-range, nonlinear pulse amplifier. This amplifier gives promise of being of universal application except where pulse-height analysis is required. A continuous monitor for emanation-contaminated air using a large-area, scintillation-phosphor-coated sphere has been built and is ready for testing and calibration. A mechanical integrator of improved reliability has been designed for the emanation monitor.

1279
National Bureau of Standards
DEVELOPMENT OF HIGH VOLTAGE BATTERY OF THE ZAMBONI PILE TYPE, extract from QUARTERLY PROGRESS REPORT TO THE U. S. ATOMIC ENERGY COMMISSION; JULY, AUGUST, AND SEPTEMBER, 1951. [nd] 9p. (NBS-D-105(extract))

Experiments on development of a Zamboni pile for use in radiation-detection equipment have continued. Colloidal Ag, painted in a thin coat, was used successfully as a metal negative electrode; a source of colloidal Zn has not yet been found. Painted coatings were made using powdered Zn with various vehicles, but the oxide coatings around the Zn particles rendered the film nonconducting. Experiments are being conducted on perfecting the techniques of molecular diffusion of Zn and Mg to form the metal negative. The results obtained with Zn seem promising. Antioxidation coatings made of carbon in an organic vehicle were tried for the outside metal surface of the negative. Experimental cells and assemblies for low-temperature use were made with various combinations of ethylene glycol, ethyl alcohol, and flour mixed with MnO_2 ore and carbon black as the positive electrode, and either sheet Mg or evaporated Al as the negative electrode; the results of discharge tests are included. Studies on electrolyte concentrations lower than 1% and binders of the Methocel-water type are reported, with various performance and capacity tests.

1280
A SENSITIVE AND REPRODUCIBLE THERMOMETER IN THE RANGE 2 TO 20°K. A. Brown, M. W. Zemansky, and H. A. Boorse. Phys. Rev. 84, 1050(1951) Dec. 1.

A half-watt carbon radio resistor has been found to function well as a secondary thermometer for use in the range 2 to 20°K. The outer plastic covering was ground away to expose the C, and the resistor was covered with clear glyptal lacquer and baked; it was then cemented into a cylindrical hole in the Nb (of which heat-capacity measurements were being made). The resistor met the following requirements: reproducibility after cycling to room temperature, high sensitivity, and negligible change of calibration in the presence of a magnetic field.

1281
A MULTIRANGE RECORDING AND CONTROL SYSTEM FOR ELECTRICAL MEASUREMENTS. J. C. Pigg. Science 114, 667-70(1951) Dec. 24.

In order to record automatically temperature and resistivity during irradiation as a function of exposure time in studies of the effect of nuclear reactor irradiation on the electrical properties of semiconductors, resistances from 0.001 ohm to 100 megohms have to be measured and recorded directly to within 0.1% accuracy. Moreover, temperatures varying from −78 to 50°C in a single experiment, exposure of two or more samples simultaneously, and the necessity for holding current or voltage at a constant predetermined value have to be anticipated. Detailed description is given of a device fulfilling these requirements consisting of a multipoint potentiometer strip-chart recorder, the necessary current and voltage control circuits, an essentially infinite impedance voltage-measuring device, the necessary automatic switching and scale-changing circuits, and a system of component terminals which facilitates the use of those components necessary for a given circuit.

ISOTOPE SEPARATION

1282
Massachusetts Inst. of Tech.
SEPARATION OF STABLE ISOTOPES, p.244-271 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Manson Benedict. Dec. 1951. (TID-5031(p.244-271))

A list of the isotopes of principal technical interest and the processes which have been used to separate the isotopes are given. The processes described are mass spectrometer, molecular distillation, electrolysis, gaseous diffusion, mass (or sweep) diffusion, thermal diffusion, chemical exchange, and gas centrifuge. Some of the novel characteristics of isotope separation plants are mentioned, with a few general conclusions regarding isotope separation.

MASS SPECTROGRAPHY

1283
Brookhaven National Lab.
MASSES OF LEAD AND BISMUTH; by P. I. Richards, E. E. Hays, and S. A. Goudsmit. Nov. 8, 1951. 4p. (BNL-1025)

The masses of Pb^{208} and Bi^{209} have been determined by measuring the time of flight of their ions in a magnetic field. The mass values are Pb^{208} = 208.0412 ± 0.0015, Bi^{209} = 209.0472 ± 0.0015, and $Bi^{209} - Pb^{208}$ = 1.0060 ± 0.0005.

1284
MASSES OF Na^{23}, K^{39}, and K^{41}. Arnim Henglein. Z. Naturforsch, 6a, 745-50(1951) Dec. (In German)

The construction of a modern parabolic mass spectrograph and ion source according to Shaw's principle (Phys. Rev. 75, 1011(1949)) is described. Precision determinations gave the mass of Na^{23} as 22.99665 ± 0.00008 amu and the doublet differences $CH_3CN^+ - {}^{41}K^+$ and $CHCN^+ - {}^{39}K^+$ as 0.06513 ± 0.00005 and 0.04758 ± 0.00008 amu, respectively.

MATHEMATICS

1285
Nuclear Development Associates, Inc.
SOME MISCELLANEOUS MATHEMATICAL PROBLEMS; by J. Ernest Wilkins, Jr. Dec. 19, 1951. 23p. (NYO-641)

This report was issued to place on record three unrelated mathematical topics which arose in connection with contract AT-(30-1)862. The discussion covers two integrals arising in the solution of transport equations. Tables of Laguerre polynomials $L_n(x)$ are given for x = 0(.1)10(.2)20 and n = 2(1)7.

MEASURING INSTRUMENTS AND TECHNIQUES

1286
Argonne National Lab.
SLOW NEUTRON LIQUID SCINTILLATION DETECTORS (abstract); by C. O. Muehlhause and G. E. Thomas. Dec. 1951. 1p. (AECU-1810; UAC-474)

Aside from the possibility of discovering a fluorescent boron compound, the problem of detecting slow neutrons with boron at very high efficiencies (~100%) reduces to the problem of discovering a boron compound which may be introduced into a fluorescent solution without quenching the fluorescence. The compound triethyl borate, $B(OC_2H_5)_3$, when added to a standard fluorescent solution of phenylcyclohexane, terphenyl, and diphenyl hexatriene satisfies the above requirement. The only effect on the alpha pulse height due to the addition of ethyl borate is to reduce it in proportion to the dilution of the original fluorescent solution. As much as one part of ethyl borate to one part of "phenyl" solution may be used, and the boron disintegration alpha pulse height is still several times the noise level. If ethyl borate enriched in B^{10} is used, the lifetime of a neutron in the detecting medium is ~0.4 μsec. Other properties and other solutions will be discussed.

1287
Argonne National Lab.
BLACKENING OF LANTERN SLIDES BY BETA EMITTERS; by L. Grossweiner. Nov. 1951. 5p. (AECU-1822; UAC-467)

Blackening curves for Kodak Contrast and Medium Lantern Slide Plates have been determined for three pure β emitters, P^{32}, RaE (Bi^{210}), and Cl^{3}, having maximum energies of 1.71, 1.17, and 0.71 Mev, respectively. The relative blackening for the 1.17-Mev β is greater than that for the 1.71-Mev, as would be expected, but that for the 0.71-Mev falls between those for the higher energies. This diminished blackening power is probably due to absorption of β particles by the emulsion. The developability probability varies slowly with energy, and that corresponding to the 0.71-Mevβ is 0.55. The lantern slides are about four times as sensitive as the single-layer emulsions studied by Okrent and Solomon (Phys. Rev. 83, 826(1951)).

1288
Oak Ridge National Lab.
A THERMAL NEUTRON SURVEY INSTRUMENT; by G. S. Hurst, D. J. Knowles, and Catherine Yochem. Issued Jan. 16, 1952. 16p. (ORNL-1134)

A thermal-neutron survey instrument capable of measuring flux values less than 50 neutrons/cm^2/sec has been developed. The $B^{10}(n,\alpha)Li^7$ reaction is used, and this permits easy discrimination against γ radiation. The detector is a proportional counter having a radius of 1.2 cm and an active length of 5 cm. When unenriched BF_3 is used at a pressure of 4 cm Hg, the sensitivity of the counter is such that a thermal flux of 150 n/cm^2/sec gives an approximate average count rate of 1 count/sec. A flux value as high as 10 times tolerance can easily be detected with no loss of counts with a simple thyratron discriminator circuit. The counter, circuit, and a curve of counting rate vs. pulse size are shown, and the methods of assembly and calibration are explained.

1289
ON THE IDENTIFICATION OF PARTICLES IN NUCLEAR EMULSIONS. L. van Rossum, R. Desprez, and M. Jannot. J. phys. radium 12, 840-7(1951) Nov. (In French)

Details involved in identifying cosmic-ray particles in specific nuclear plates exposed at the equator and at a

median latitude are presented. Quantitative determination of the degree of development and evolution of the latent image is discussed. Determination of the relative masses of π and μ mesons by grain counting in a plate exposed to neutrons from the Berkeley cyclotron is described; the resulting ratio was 1.3 ± 0.1.

1290

XENON GEIGER COUNTERS. Gilbert Barrère. Compt. rend. 233, 1442-4(1951) Dec. 3. (In French)

A plateau of 400-v length and of only 3% slope was obtained in a Maze-type, stable, self-quenching Geiger counter filled with 72 mm Hg of Xe and 8 mm Hg of ether by intensive purification of the ether by chemical means and of the Xe by use of a liquid-O_2 trap.

1291

THE PROPORTIONAL COUNTER IN X-RAY DIFFRACTION WORK. A. R. Lang. Nature 168, 907-8(1951) Nov. 24.

The proportional counter, as a detector for measuring the intensities of diffracted x rays, has the following advantages over Geiger counters: counting losses are negligible for all x-ray intensities likely to be realized with conventional x-ray generators and diffraction techniques, unwanted radiations may be discriminated against, and the proportional counter is more economical, its lifetime being practically infinite. The proportional counter used is described, and diffraction spectra of powdered chrome alum taken with it and with the best commercially available Geiger counter are shown and compared.

1292

USE OF A MICRODENSITOMETER TO STUDY NUCLEAR EMULSIONS. Marie Ader, Jean Debiesse, Théo Kahan, and Louis Rougeot. Compt. rend. 233, 1446-7(1951) Dec. 3. (In French)

Brief mention is made of an apparatus by which angular distribution of scattered or emitted nuclear radiations may be studied by photographic densitometry. The film is mounted on the interior surface of a half ring at whose center of radius is mounted a scatterer or source. The half ring may be rotated about its axis, or the scatterer may be rotated. The microdensitometer tracing of α-particle distribution from a plated Po source is shown as an example of the results obtained.

1293

MULTIPLE SCATTERING AND GRAIN DENSITY MEASUREMENTS ON ELECTRON TRACKS IN G-5 EMULSIONS. I. B. McDiarmid. Phys. Rev. 84, 851-2(1951) Nov. 15.

Ilford G-5 plates have been exposed to x rays from a 70-Mev synchrotron, and a study has been made of the electron tracks from the pairs produced in the emulsion. The energy of each electron was determined by the scattering method. The method used to measure the scattering was a modification of Fowler's (Phil. Mag. (7) 41, 169 (1950)) coordinate method. Grain-counting data show an increase in grain density of ~7% in the region E/μ (kinetic/rest energy) = 7 to 40 or 60, after which the density is constant.

1294

AN EXPLANATION OF DIFFERENCES IN COUNTING PROPERTIES AMONG DIAMOND SPECIMENS. G. P. Freeman and H. A. Van Der Velden. Phys. Rev. 84, 1050-1(1951) Dec. 1.

An attempt has been made to correlate the counting properties of diamonds with the following properties: spectral transmission in the region 3000 to 2250 A, absence of streaks of birefringence, and luminescence. The following conclusions are drawn: the counting property is a property of the crystal itself and not a consequence of the imperfection of the crystal; the laminations observed by Raman, Randall, and Ramachandran (Proc. Indian Acad. Sci. 19A (1944); 24A (1946)) are in fact a well-ordered mosaic superstructure of small octahedrons; the selection of counters is improved from ~30 to ~75% if the absence of streaks of birefringence is used as a criterion together with the ultraviolet transparency; luminescence is a consequence of impurities; and the suggestion of correlation between counting and luminescence obtained with irradiation at 2250A was not confirmed.

1295

STUDY OF PHOTOELECTRONS IN SPECIAL PHOTOGRAPHIC PLATES FOR NUCLEAR STUDIES. J. M. Blum. J. phys. radium 12, 860-3(1951) Nov.

The x-ray spectrograph used in this systematic study of the photoelectrons produced in nuclear plates by monochromatic x radiation is illustrated. A range-energy curve is given for electrons in nuclear emulsions, including results obtained in the present investigation for photoelectrons emitted from atomic layers of Br and Ag.

1296

EXTERNAL-CATHODE GEIGER-MUELLER COUNTERS WITH FILLINGS POSSESSING VERY LOW TEMPERATURE COEFFICIENTS. G. Fauny, M. Fauny, and M. Schérer. J. phys. radium 12, 954-5(1951) Dec. (In French)

Brief mention is made of plateau changes with temperature in Maze-type G-M counters filled with 0.05 mm Cl_2 + 0.20 mm A + 200 mm Ne, 12 mm methylal + 60 mm A, or 16 mm isobutane + 60 to 100 mm A over the range −8 to +80°C. The temperature coefficient was practically zero in all cases except for the isobutane-filled counter at low temperature, attributed to condensable impurities.

MESONS

1297

DETERMINATION OF THE MEAN LIFE-TIME OF μ-MESONS. J. Pernegr. Nature 168, 1004(1951) Dec. 8.

The photographic-emulsion method has been applied to the determination of the mean lifetime of μ mesons from their anomalous absorption. A batch of Ilford C2 plates was exposed without absorber to cosmic radiation at an altitude of 1780 m. A second batch was exposed at 2640 m under a Pb absorber corresponding in stopping power to the layer of air between the two stations. The rest mass m_0 of the μ meson was determined by grain-counting and Coulomb-scattering methods as $m_0 = 110$ Mev/c^2. The mean life-time τ_0 was calculated as $\tau_0 = 2.3 \pm 0.3 \times 10^{-6}$ sec from the formula $\tau_0 = \frac{m_0}{p} L$, where p = effective momentum and L = mean range before decay; L is a function of differences in height and number of mesons at the two altitudes. These measurements show that ρ mesons are almost exclusively μ mesons.

1298

EXPERIMENTAL DETERMINATION OF THE ENERGY SPECTRUM OF THE μ-MESON DISINTEGRATION ELECTRON. A. Lagarrigue and C. Peyrou. J. phys. radium 12, 848-53(1951) Nov. (In French)

A Wilson cloud chamber in a 3750-gauss magnetic field and an anticoincidence circuit was used to photograph cosmic-ray μ mesons coming to rest in a graphite screen and their disintegration electrons. The results of 65 measurements are reported and are compared with theory and Anderson's results (Phys. Rev. 75, 1432(1949)). The maximum energy of the spectrum was found to be 54.6(+3.3, −2.3) Mev, in good accord with the hypothesis that the three particles emitted in the disintegration have masses negligible with respect to that of the μ meson.

1299

ZENITHAL DISTRIBUTION OF LOW ENERGY MESONS. Andre G. Viosin. Phys. Rev. 84, 850-1(1951) Nov. 15.

By an arrangement of counters and absorbers such that only the particles which stop in a block of Pb are detected, the zenithal distribution of the meson spectrum at sea level has been investigated in the momentum ranges 300 to 410 Mev/c and 410 to 510 Mev/c. The data were found to fit a function of form $r = 1\text{-}a \sin^b \theta$, where r is the ratio of the counting rate at angle θ with the zenith to the counting rate at angle 0° with the zenith ($r = I_\theta / I_0$ for the particular energy range). The constants a and b have the following values: $a = 0.98 \pm 0.02$, $b = 1.47 \pm 0.12$, for the spectral band 300 to 410 Mev/c; $a = 1.03 \pm 0.03$, $b = 1.61 \pm 0.15$, for the spectral band 410 to 510 Mev/c. No appreciable meson component coming upward from the earth was detected. The angular distribution (at angles between 0 and 80°) of cosmic-ray mesons in the two momentum bands was found to show a marked decrease in intensity near the zenith and a tendency to more isotropy for the larger angles.

1300

CONTINUOUS γ RADIATION ACCOMPANYING THE DISINTEGRATION OF THE μ MESON. A. Abragam and J. Horowitz. J. phys. radium 12, 952-4(1951) Dec. (In French)

Disintegration of a μ meson into an electron and two neutrinos results in electromagnetic radiation from acceleration of the light electron. The spectrum and total energy of this radiation have been calculated by adding to the interaction Hamiltonian an electromagnetic interaction which couples the meson and electron with the radiation, and performing a perturbation calculation of the second order. The equations are given. The average energy dissipated in the form of photons in μ-meson disintegration has been calculated to be $\sim 3.3 \times 10^{-3}\ Mc^2$, where $M = 210 m_e$.

1301

ON A PHENOMENOLOGICAL APPROACH TO MESON PRODUCTION IN NUCLEON-NUCLEON COLLISIONS. E. A. Power. Proc. Roy. Soc. (London) 210A, 85-98(1951) Dec. 7.

The validity of certain phenomenological approaches to spin zero meson production in nucleon-nucleon collisions is considered. It is shown that, to first-order perturbation theory, a method analogous to the distorted wave approximation is valid. Comparison is made with a bremsstrahlung-like calculation which, for neutral mesons with nonderivative coupling to the spinor field, gives no production, since the nucleon recoil is neglected. Application of the distorted wave approach to neutral meson production in proton-neutron collisions, and comparison with the results for production of charged mesons in proton-proton collisions is sketched. Results are quoted for simple inverse processes. (auth)

MOLECULAR PROPERTIES

1302

Spectroscopic Lab., Univ. of Chicago

REPORT FOR PERIOD APRIL 1, 1950, TO MARCH 31, 1951; PART II. [nd] 297p. (NP-3552; U-18908)

This report lists articles describing research partly or wholly supported by the contract and not indicated in previous reports, complete texts of finished manuscripts and articles in press, and summaries of additional work in progress. The following articles are reproduced: Magic Formula and the Structure of Bond Energies (abstract); Lewis Acids and Bases and Molecular Complexes; Structure and Spectra of Molecular Complexes; LCAO Molecular Orbital Computation of Resonance Energies of Benzene and Butadiene, with General Analysis of Theoretical versus Thermochemical Resonance Energies; The Ultraviolet Spectra of Benzene-Halogen Complexes and of Iodine in Solution; Spectra, Stability Constants, and Structures Formed by Aniline and Aromatic Nitrohydrocarbons; The Vacuum Ultraviolet Absorption Spectra of Peptides and Polypeptides; The Absorption Spectra of Some Substituted Benzenes and Naphthalenes in the Vacuum Ultraviolet; The Far Ultraviolet Absorption Spectra of the Hydrides and Deuterides of S, Se, and Te and of the Methyl Derivatives of H_2S; The Absorption Spectrum of Ketene in the Far Ultraviolet; The Infrared Absorption Spectra of Boron-Nitrogen Compounds; Rotation-Vibration Spectra of Diatomic and Simple Polyatomic Molecules with Long Absorbing Paths. IV. The Spectrum of Methyl Fluoroform (CH_3CF_3) from 19μ to 0.7μ; The Infrared Spectra of Certain Electrolytes in Pyridine and Other Organic Solvents; The Infrared Spectra of B_2Cl_4 and CBl_3; Electronic Structure and Excitation of Polyenes and Porphyrins. (See NP-3185 for Part I.)

1303

A QUANTUM MECHANICAL STUDY OF LITHIUM HYDRIDE. Inga Fisher. Nature 168, 1002(1951) Dec. 8.

The electronic energy of lithium hydride has been computed by the Hartree-Fock approximation. The computations were carried out both by the linear combination of atomic-orbitals approximation according to the molecular-orbital method, and by the electron-pair approximation according to Heitler and London with inclusion of ionic terms. When only the two valence electrons were considered, the computed energy values (3.57 and 3.68 ev) were larger than the experimental value (2.54 ± 0.2 ev). Therefore the energy of the lithium hydride molecule was computed with a wave function including molecular orbitals for all the four electrons of the molecule, and a value of 2.0 ev was obtained. The best values of the parameters in the wave functions indicate that the structure Li^+H^- is the most important one. The degree of s,p hybridization around the Li atom was also calculated; the 2p orbital was found to be much less important than the 2s when the molecular orbitals of all four electrons were included, in contrast to the two-valence-electron calculation.

NUCLEAR PHYSICS

1304

Columbia Univ.

NUCLEAR PHYSICS LABORATORIES PROGRESS REPORT FOR JULY, AUGUST, SEPTEMBER, 1951; by W. W. Havens, Jr., Director. Nov. 26, 1951. 25p. (CU-97; DR-1704)

Preliminary data from neutron-velocity spectrometer measurements, made to obtain level parameters, are given for Cr, Ga, Mn, and Re. Capture of neutrons at various energies was investigated by measuring γ rays from a target in the velocity spectrometer, and data are given for Ag and Cd. In neutron-scattering experiments, Ni was measured as a calibration point corresponding to a pure scatterer; data are included. Coherent cross sections obtained by neutron mirror experiments are given for Mg, Cu, and Te. The β-spectrum of RaE(Bi^{210}) was reinvestigated with strong and uniformly evaporated sources to look for a weak γ ray or associated conversion electrons. None was found, and previous measurements of the anomalous RaE spectrum shape were corroborated. The β^- spectrum of Tl^{204} was determined to be of α type ($\Delta I = 2$, change of parity) with K capture from 5 to 10% of β emission.

1305

Palmer Physical Lab., Princeton Univ.

THE FORMATION OF TRIPLET POSITRONIUM IN GASES; by T. A. Pond. [nd] 6p. (NYO-3002)

The probability of three-photon decay of positronium has been measured by comparing the two-photon coincidence rates under circumstances which are identical except that in one case triplet positronium is allowed to annihilate and

in the other substantially all the positrons are forced to decay with two photons. A Na^{22} source was placed in a gas chamber in a magnetic field, and two scintillation counters were arranged to detect 180° coincidences. The coincidence rate was first measured in the gas (e.g.,A) with 3% NO added and then in A with 3% N_2 at the same total pressure. The NO gives rise to electron exchanges which can convert triplet to singlet positronium and vice versa, and the fraction of positrons which annihilate with three photons from the triplet state is $\frac{N_{A+NO} - N_{A+N_2}}{N_{A+NO}}$, where N_{A+NO} is the counting rate in A with NO added, etc. Preliminary data on the fraction of positrons stopped in various gases in a mean field of 5620 gauss which decay from the triplet state of positronium by three-photon emission are in H_2, 0.188; N_2, 0.114; A, 0.166; and He, 0.169.

1306

CONTRIBUTION TO THE COVARIANT STUDY OF THE NUCLEAR FIELD. ANALYSIS OF NUCLEON-NUCLEON SCATTERING PROCESSES. Claude Marty. Ann. phys. (12) 6, 830-94(1951) Sept.-Oct. (In French)

In this doctoral thesis, the author first collects the principal experimental information relative to nucleon-nucleon scattering and contrasts the phenomenological and meson theories of nuclear forces. A covariant theory of fields is developed in which relativistic effects are taken into account automatically. The elastic scattering matrix of two nucleons is calculated, and the interaction representation is derived by a method different from that of Heisenberg. Limitations of various meson theories are discussed.

NUCLEAR PROPERTIES

1307

A CONTRIBUTION TO THE STUDY OF NUCLEAR MAGNETIC MOMENTS. Georges J. Béné. Helv. Phys. Acta 24, No. 4, 367-88(1951) Sept. 20. (In French; see also NSA 5-1347)

Experiments are described in which Bloch's method was applied to a determination of the gyromagnetic ratio of the F^{19} nucleus. The result obtained, 0.94076 ± 0.00005, measured in an air field, is in good agreement with previous results. The resonance fields of the proton in an electromagnet gap and in an air core were compared, with the intention of studying the spin-spin interaction proposed by Stueckelberg. This interaction was not observed, its order of magnitude being clearly smaller than the α fine structure constant. An original method of determining the transverse relaxation time of nuclei is considered.

1308

PURE QUADRUPOLE SPECTRA: THE SUBSTITUTED METHANES. Ralph Livingston. J. Chem. Phys. 19, 1434(1951) Nov.

The pure quadrupole spectra of Cl isotopes in a number of substituted methanes have been measured by observing quadrupole splittings in the rotational transitions in the microwave region. Two or more closely spaced lines were frequently found, and in such cases the average frequency was used to compute an average coupling, taken to be twice the frequency. The observed frequencies at three temperatures and the computed nuclear quadrupole couplings at 20°K for Cl^{35} are tabulated. Regularities in trend of the couplings are pointed out and given possible explanations.

1309

ON THE RATIO OF THE NUCLEAR QUADRUPOLE MOMENTS OF COPPER ISOTOPES. G. Becker. Z. Physik 130, No. 4, 415-26(1951). (In German)

The magnetic nuclear resonances of Cu^{63} and Cu^{65} in a $K_3[Cu(CN)_4]$ single crystal split into three components as a consequence of the interaction of the nuclear electric quadrupole moments with the inhomogeneous electric field of the crystal. The greatest splittings, which in the case of Cu isotopes (spin I = 3/2) are equal to the quadrupole coupling constants, are 1.113 ± 0.003 and 1.030 ± 0.003 Mc for Cu^{63} and Cu^{65}, respectively. Calculation of interaction terms gives the quadrupole-moment ratio $Q_{Cu^{63}}/Q_{Cu^{65}}$ = 1.081 ± 0.003. The most probable value of both quadrupole moments is $-(0.2 \pm 0.1) \times 10^{-24}$ cm².

1310

THE HYPERFINE STRUCTURE OF $^2P_{1/2}$ STATE OF THE STABLE CHLORINE ISOTOPES. John Gordon King and Vincent Jaccarino. Phys. Rev. 84, 852-4(1951) Nov. 15.

From observations of the hyperfine structure interaction in an external magnetic field, the nuclear magnetic dipole coupling constants ($a_{1/2}$) for the $^2P_{1/2}$ metastable state of the stable Cl isotopes have been obtained. The atomic-beam magnetic-resonance method was used. The following results were obtained: μ^{35} = 0.82 ± 0.08 nuclear magnetons, $\Delta\nu^{35}_{1/2}$ = 2074.383 ± 0.008 Mc/sec, $\Delta\nu^{37}_{1/2}$ = 1726.700 ± 0.015 Mc/sec; $a^{35}_{1/2}a^{37}_{1/2}$ = 1.201357 ± 0.000013.

1311

ON THE POSSIBILITY OF ORIENTING ATOMIC NUCLEI BY A DOUBLE RESONANCE METHOD. Alfred Kastler. Compt. rend. 233, 1444-6(1951) Dec. 3. (In French)

The simultaneous application of an electronic magnetic resonance and a nuclear magnetic resonance to a paramagnetic substance at liquid-He temperatures results in appreciable nuclear alignment. The method may be used to study anisotropic nuclear reactions.

1312

PARAMAGNETIC RESONANCE IN LIQUIDS. Michael Tinkham, Roy Weinstein, and Arthur F. Kip. Phys. Rev. 84, 848-9(1951) Nov. 15.

Paramagnetic resonance absorption in solutions containing Mn^{++} ions has been observed in solutions sufficiently dilute for the hyperfine structure to be easily observed. All observable structure is explained by the simple Hamiltonian $\mathcal{H} = g\beta\mathbf{H}\cdot\mathbf{S} + A\mathbf{I}\cdot\mathbf{S}$, where g is the g value of a free electron. The observed lines fit the absorption lines predicted by the formula when g = 2.001 ± 0.001 and A = 95 gauss. The line width between half-maximum points was found to be nearly a linear function of Mn^{++} ion concentration when total ionic strength was held constant, and also of total ionic concentration when a solution of a nonmagnetic salt was added and the Mn^{++} ion concentration held constant. The widths are interpreted in terms of electric and magnetic perturbations produced on the absorbing ion by its ionic neighbors and by the sheath of water molecules surrounding it.

1313

NUCLEAR RADII. D. Curie. J. phys. radium 12, 941-9 (1951) Dec. (In French)

Methods of measuring nuclear radii are reviewed, values are tabulated, and variation with mass number A is discussed. The most recent measurements have a relative accuracy of 1% and permit correlation of nuclear radii with modifications in the nuclear structure. 43 references.

1314

NUCLEAR MASSES AND CLOSED SHELLS IN REGION A <65. A. H. Wapstra. Phys. Rev. 84, 838-9(1951) Nov. 15.

A diagram is presented of the difference between the author's new list of nuclear masses (Phys. Rev. 84, 837 (1951)) and the masses computed from a corrected Weizsäcker-Bethe formula. The differences are shown as a function of neutron excess and mass number. The mini-

mum in the mass differences around the magic numbers is fairly wide, making it difficult to choose between two possible values for a magic number. It is possible that the formula $\frac{1}{3}$ m(m² + 5) represents the whole magic-number series, which then runs 2, 6, 14, 28, 50, 82, 126. In this picture the exceptional stability of O^{16} and Ca^{40} should be the result of their being α-particle nuclei; while the magic character of Z = 20 is further suggested by the stability of Ca^{48}, the latter in reality is the result of N = 28.

NUCLEAR REACTORS

1315
Brookhaven National Lab.
REACTOR MATERIALS REQUIREMENTS; by David H. Gurinsky. [nd] 9p. (BNL-1054)

The qualifications of graphite and Be as materials for moderators are discussed in some detail. Metallurgical research on metals of high strength and low density is reviewed.

1316
NEPA Div., Fairchild Engine and Airplane Corp.
A HIGH TEMPERATURE FURNACE FOR USE IN NEUTRON REACTORS; by W. E. Browning, L. Martel Bratcher, and H. T. King. Mar. 16, 1951. 9p. (NEPA-1864)

A furnace suitable for application at temperatures up to 1500°C was constructed for use in a nuclear reactor. Special characteristics such as compactness, long life, ease of changing specimans, low neutron poisoning effect and relatively low induced radioactivity were incorporated in its design. Design, construction, and performance details are given. (auth)

1317
General Electric Co.
SOME ECONOMIC ASPECTS OF ATOMIC POWER, p.16-33 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by C. G. Suits. Dec. 1951. (TID-5031(p.16-33))

The economic aspects of a power breeder are considered. The cost of construction and operation of a typical steam electric-power-generating plant is compared to a hypothetical nuclear steam electric plant of 400-Mev power output. The cost of a conventional boiler was calculated to be $18,400,000 and the reactor-boiler plutonium producer might cost $65,000,000 and still permit competitive cost on power production. This cost of the hypothetical power-breeder reactor is compared to published cost of the experimental reactor of Brookhaven National Laboratory. This unit, rated at 30 Mev, is stated to cost approximately $25,000,000. After considering these and other factors it is estimated that the cost of building a power-production reactor of 1000-Mev output under current limitations of technology might be in the range of $50,000,000 to $100,000,000. It is surprising to find that there is not a greater divergence between economically permitted maximum reactor costs and the postulated costs of reactor construction. It is clear that the real economic interest of these plants depends upon the development of an efficient breeder cycle.

1318
Atomic Energy Commission
THE ATOMIC ENERGY COMMISSION REACTOR PROGRAM, p.34-57 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Lawrence R. Hafstad. Dec. 1951. (TID-5031(p.34-57))

A general discussion is given of the reasons for developing the particular reactors in the AEC program. The possibility of developing a breeder reactor is considered. The amount of energy available in the world is compared to the estimated world needs. It is thought that nuclear power is just an interim expedient until that day when the world will be using continuous solar energy. The necessity for security in the AEC Research Program is discussed.

1319
North Carolina Univ.
A SIMPLIFIED APPROACH TO REACTOR CALCULATION, p.152-175 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by A. V. Masket. Dec. 1951. (TID-5031(p.152-175))

A rapid survey is made of the mathematical ideas associated with nuclear reactors involving uranium and neutron chain reactions. The topics discussed are concerned for the most part with the dynamic equilibrium state of such chain reactions. A reactor in this discussion is imagined as a well-defined volume of matter containing in part or in entirety a uniformly distributed concentration of the isotope U^{235} in some other homogeneous material called a moderator. The purpose of the paper is to indicate in simplified form what conditions are placed on such an arrangement so that it may be chain reacting.

1320
Oak Ridge National Lab.
CHEMICAL PROBLEMS IN THE DEVELOPMENT OF NUCLEAR REACTORS, p.210-243 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by J. A. Swartout. Dec. 1951. (TID-5031(p.210-243)

The chemical and engineering problems in the development of nuclear reactors are divided into three general categories: The first of these is the provision of materials for the construction and operation of the reactor system, including the nuclear fuel, neutron moderator, coolant, and structural materials. The specifications for each are directly dependent upon the individual reactor type and are considered separately. In the second category are the problems connected with the design, construction, and operation of the reactor itself. Included are the measurement of nuclear constants, the investigation of chemical effects upon the reactor unit induced or produced by nuclear radiation, and provisions for maintaining the chemical portion of the reactor. The extent and variety of the chemical problems are highly dependent upon the specific reactor design. The last group includes problems which place the greatest burden on chemical engineering. These are the problems involved in the chemical processing of the partially expended reactor fuels in order (1) to obtain the fissionable material and/or (2) to recover the residual fuel. The problem confronted by the chemical engineer for the stationary and the mobile power units are discussed separately.

1321
Tennessee Univ.
INSTRUMENTATION AND CONTROL OF REACTORS, p.311-331 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by J. D. Trimmer. Dec. 1951. (TID-5031(p.311-331))

A short survey is given of reactor instrumentation and control. The measurable quantities important for reactor control which are discussed are neutron flux, period of neutron-flux change, neutron-energy spectrum, fission rate, radiation, reactivity, and fuel concentration. The control of the reactor as affected by reactor kinetics, the space dependence of the control rod, relation to its load, and mathematical status are also considered.

1322
North American Aviation, Inc.
HAZARDS OF LOW POWER RESEARCH REACTORS, p.411-421 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by M. M. Mills. Dec. 1951. (TID-5031(p.411-421))

The hazards of low-power research reactors are discussed. A thermal, enriched, homogeneous solid-core reactor structure with a large transient negative temperature coefficient is shown to have intrinsic safety characteristics. The behavior of the power level of a reactor with a negative transient reactivity coefficient is described.

1323
Oak Ridge National Lab.
A SURVEY OF REACTOR TYPES, p.422-449 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by Neal F. Lansing. Dec. 1951. (TID-5031(p.422-449))

This survey touches on three types of reactors: (1) graphite-natural U, (2) heavy-water–natural U, and (3) light-water-enriched U systems. The discussion of the types of reactors is developed on the basis of the Manhattan Project history. 15 figures.

1324
Radiation Lab., Univ. of Calif.
SUMMARY OF RESEARCH PROGRESS MEETING OF OCTOBER 4, 1951; by Sergey Shewchuck. Nov. 30, 1951. 4p. (UCRL-1585)

Oscillator Problems at Argonne 60-in. Cyclotron. W. W. Salisbury. Some of the difficulties in getting the oscillator started are discussed briefly. A method of separately exciting the oscillator system, using four ML 354 tubes connected in grounded-grind arrangement, has worked well. The grid filament is driven by two type 880 tubes. There is very little interaction back to the oscillator from the dee system. The area of the coupling loop is small and its impedance is low. The system is easy to keep in tune, is very stable, and has a very high Q value.

1325
HOW RADIOISOTOPES ARE MANUFACTURED. Ch. Fisher. Atomes 6, 399-402(1951) Dec. (In French)

An elementary account of pile production of radioisotopes is illustrated by photographs showing the method used to introduce into the Châtillon pile (ZOE) a graphite brick containing the substance to be irradiated. About 1500 shipments of radioisotopes have been made from this pile since May 1949. The present rate of shipments is about 150 a month.

NUCLEAR TRANSFORMATION

1326
Radiation Lab., Univ. of Calif.
INTERPRETATION OF EXPERIMENTS ON THE PHOTONUCLEAR EFFECT IN HEAVY ELEMENTS; by L. Eyges. Nov. 30, 1951. 32p. (UCRL-1581)

The experiments to date on photonuclear reactions in heavy nuclei are analyzed, and a correlation is found between the energy at which the (γ,n) cross section is a maximum and the $(\gamma,2n)$ threshold energy. The shape of the total-photon-absorption cross sections in Sb and Ta can be estimated up to 22 Mev, and there is an indication that the cross section drops off strongly above that energy. Using the estimate of the shape of the total cross section in Ta, one can calculate the neutron yield to be expected in experiments with 330-Mev bremsstrahlung. The calculated value is only about 60% of the experimental value. Evidence shows that the discrepancy is due to neutrons produced by high-energy photons, presumably due to mesonic effects. The integrated cross sections for Zn^{64}, Sb, and Ta^{181} are evaluated, and the fraction of exchange force in the neutron-proton interaction is evaluated by comparsion with the Levinger-Bethe formula. (cf. UCRL-1536; NSA 6-364)

1327
NUCLEAR STRUCTURE IN FISSION. L. E. Glendenin, E. P. Steinberg, M. G. Inghram, and D. C. Hess. Phys. Rev. 84, 860-1(1951) Nov. 15.

Mass-spectrometric investigations of the relative abundances of Mo and Zr isotopes produced in U^{235} fission have shown an abnormally high yield in the mass region 98 to 100. A yield-mass curve is plotted with the heavy fission products reflected over the light group so that the masses of complementary fission products sum to 233.5; the coincidence of the anomalies at masses 98 to 100 and 133 to 136 is clearly shown. Possible explanations of the observed anomalies are discussed. The high yield at Mo^{100} suggests a preference for this mass in the fission act, perhaps as the complement of a preferred 82-neutron shell in the heavy fragment.

1328
STUDIES OF NUCLEAR COLLISIONS INVOLVING 8 MEV DEUTERONS BY THE PHOTOGRAPHIC METHOD. I. THE EXPERIMENTAL METHOD. H. B. Burrows, C. F. Powell, and J. Rotblat. Proc. Roy Soc. (London) 209A, 461-77(1951) Nov. 22.

An improved apparatus for the study of disintegrations produced by high-energy particles accelerated in a cyclotron has been constructed. The instrument employs the photographic method of detecting charged particles, and allows the numbers and energy of the scattered and disintegration products to be determined—at any angle with respect to the primary beam, in the interval from 15 to 165°—as a result of a single exposure. By means of a slit system, the spread in energy of the deuteron beam from the Liverpool cyclotron has been reduced to 60 kev, and the angular divergence of the beam to ±⅓°. "Targets" composed of gases or thin foils have been used. The Q values of the resulting nuclear reactions which lead to the emission of protons and α particles can, in the refined conditions provided by the instrument, be determined to within ±0.03 Mev; separate proton groups with a difference of energy of 0.08 Mev can be resolved. (auth)

1329
STUDIES OF NUCLEAR COLLISIONS INVOLVING 8 MEV DEUTERONS BY THE PHOTOGRAPHIC METHOD. II. THE ENERGY OF THE EXCITED STATES OF ^{17}O. H. B. Burrows, C. F. Powell, and J. Rotblat. Proc. Roy. Soc. (London) 209A, 478-88(1951) Nov. 22.

The apparatus described in part I has been employed to determine the energy of the excited states of the nucleus O^{17} by observations on the protons from the reaction $O^{16}(d,p)O^{17}$, and on the α particles from the reaction $F^{19}(d,\alpha)O^{17}$. The protons from the first reaction were observed at five angles of emission with respect to the primary beam, and the α particles from the second at four angles. Thirteen excited states of O^{17} were observed, evidence for ten of which was given by both reactions. The values for the energy in the different excited states, derived from both reactions and at different angles of observation, are in good agreement. The Q values of the reactions $O^{16}(d,p)O^{17}$ and $F^{19}(d,\alpha)O^{17}$, in which the O^{17} nucleus is formed in its ground state, are 1.928 and 10.042 Mev, respectively. The Q value for the reaction $O^{16}(d,\alpha)N^{14}$ was found to be 3.09 Mev, and the existence of two excited states of N^{14} was established. Ten excited states of F^{20} were observed in a study of the proton groups from the reaction $F^{19}(d,p)F^{20}$. (auth)

1330
STUDIES OF NUCLEAR COLLISIONS INVOLVING 8 MEV DEUTERONS BY THE PHOTOGRAPHIC METHOD. III. ANGULAR DISTRIBUTION OF THE CHARGED PARTICLES PRODUCED BY THE BOMBARDMENT OF HYDROGEN AND DEUTERIUM. H. B. Burrows, W. M. Gibson, and J. Rotblat. Proc. Roy. Soc. (London) 209A, 489-501(1951) Nov. 22.

Apparatus previously described in part I has been used to study the angular distribution of the charged particles from nuclear processes initiated by 8-Mev deuterons. The experimental technique and the method of obtaining relative values of the yield at different angles in the center-of-mass system are described. Results of measurements on the elastic collision of deuterons with protons are given, together with an account of the method for obtaining absolute values of cross sections from the relative values, using the known cross section for this process measured by other experimenters. Angular distributions obtained for deuterons elastically scattered by deuterons, and for protons from the reaction $H^2(d,p)H^3$, are produced, and their interpretation discussed. (auth)

1331
PHOTOTRIPARTITION OF C^{12} BY THE 17.6-MEV γ RAY OF PROTON-BOMBARDED LITHIUM. Raymond Chastel. Compt. rend. 233, 1440-2(1951) Dec. 3. (In French)

Observations on the angular distribution of the α particles from the $C^{12}(\gamma,3\alpha)$ reaction are interpreted as proof that an excited state of Be^8 does not occur as an intermediate step in this reaction, but that tripartition of the C^{12} nucleus occurs.

1332
GAMMA-NEUTRON CROSS SECTIONS FOR N^{14} AND O^{16}. H. E. Johns, R. J. Horsley, R. N. H. Haslam, and A. Quinton. Phys. Rev. 84, 856-7(1951) Nov. 15.

The cross sections for the reactions $O^{16}(\gamma,n)O^{15}$ and $N^{14}(\gamma,n)N^{13}$ have been determined with x rays from a 25-Mev betatron. The saturated specific activity curve for O^{16} has a slowly increasing initial portion with almost constant slope for ~4 Mev. The neutron yield at 22 Mev is 1.68×10^4 neutrons/mole/r. The O^{16} cross-section curve shows an almost constant cross section from 17 to 20 Mev, followed by a rapidly rising portion to a peak value of 11.4 mb at 24.2 Mev. The neutron yield at 22 Mev for N^{14} is 2.38×10^4 neutrons/mole/r. The saturated specific-activity curve for N^{14} has a small hump in the initial portion. The cross-section curve shows a small peak at ~13 Mev and a larger one of 2.84 mb at 24.2 Mev. The ratio of the O and N integrated (γ,n) cross sections to their peak positions is 2.08.

1333
ON CREATION OF PAIRS OF PARTICLES IN COLLISION PROCESSES BETWEEN SPIN-½ PARTICLES. Gérard Petiau. J. phys. radium 12, 911-19(1951) Dec. (In French)

Equations for the differential scattering cross section are derived for the collision of two spin-½ particles A and B in which a spin-½ particle E goes from an unobservable negative energy state to a positive energy state manifested by the appearance of a particle pair. The different cases corresponding to the intervention of scalar, pseudoscalar, or vector fields in the interaction between A, B, and E are considered, as well as the problems associated with the total or partial unobservability of the particles.

1334
ON CAPTURE OF NEUTRONS FROM A NUCLEUS. V. I. Mamasakhlisov. Zhur. Eksptl'. i Teoret. Fiz. 21, 948-9 (1951) Aug. (Letter to the editor; in Russian)

The concept of the reverse Oppenheimer-Phillips process, developed by Galanin (Zhur. Eksptl'. i Teoret. Fiz. 18, 559-61(1948)), is applied to the disintegration of Be^9 by low-energy proton bombardment. Calculated cross sections for deuteron emission are in approximate agreement with published experimental results (Allen, Phys. Rev. 51, 182 (1937)).

PARTICLE ACCELERATORS

1335
OPTICAL FOCUSING OF NEUTRAL ATOMS. Helmut Friedburg. Z. Physik 130, No. 4, 493-512(1951). (In German; see also NSA 5-5752)

The theory of focusing of beams of neutral paramagnetic particles by an inhomogeneous magnetic field is discussed, and an experimental apparatus is described.

1336
THE REGENERATIVE DEFLECTOR FOR SYNCHRO-CYCLOTRONS. K. J. Le Couteur. Proc. Phys. Soc. (London) 64B, 1073-84(1951) Dec. 1.

Tuck and Teng have proposed to extract the beam from a synchrocyclotron by modifying the normal magnetic field in such a way as to build up the amplitude of radial oscillations until protons can escape from the magnet. In the present paper the method is studied analytically, and formulas are derived which express the performance in terms of the magnetic field perturbations; these formulas have been evaluated numerically in sufficient detail to guide practical design. (auth)

1337
HEAVY BEAM LOADING IN LINEAR ELECTRON ACCELERATORS. K. Johnsen. Proc. Phys. Soc. (London) 64B, 1062-7(1951) Dec. 1.

The influence of the beam current on the length, the obtainable particle energy, and the efficiency of a linear accelerator are considered. The beam loading is especially important if the accelerator waveguide has low losses. The efficiency, defined as the ratio of h-f power transformed into kinetic energy to the total h-f power fed to the accelerator, can have a high value, 70 to 80%, but the particle energy obtainable drops considerably with heavy beam loading. (auth)

1338
CURRENTS IN A HIGH-VOLTAGE ION ACCELERATOR TUBE. E. K. Inall. Proc. Phys. Soc. (London) 64B, 1068-73(1951) Dec. 1.

It is well known that a large electron current passes through a vacuum tube when used for the electrostatic acceleration of positive ions. This paper deals with experiments which show that many of the electrons are produced by neutral particles bombarding the lower end of the tube. The particles are formed in the region of the ion source canal and have a low energy due to the extraction potential. It has been found possible to suppress all the electrons produced below the bottom of the accelerator tube. (auth)

RADIATION ABSORPTION AND SCATTERING

1339
Nebraska Univ.
RANGE OF PROTONS IN HYDROGEN AND OXYGEN; by Charles J. Cook, Emerson Jones, and Theodore Jorgensen. [nd] 2p. (AECU-1812)

The extrapolated ionization range of protons in H_2 and O_2 gas has been measured over a proton energy range from 2.5 to 42 kv and over a pressure range from 0.5 to 1.4 mm Hg for H_2 and over a proton energy range from 20 to 40 kv and over a pressure range from 0.1 to 1.8 mm Hg pressure of O_2. A beam of analyzed protons produced by an accelerator was brought into a stopping chamber 6 ft long and 6 in. in diameter, without passing through a thin film. This was accomplished by means of differential pumping. The range of the protons was measured with a shallow ionization chamber which could be moved through most of the

length of the stopping chamber. The ionization chamber had two grids; the first was made negative to repel the electrons formed in front of the chamber and the second was at ground potential. The collecting plate was held at a positive potential to collect the electrons from the gas ionized in this chamber and to stop secondary electrons. The beam current was small compared to the ionization current. For a range determination, values of the current were plotted against the ionization-chamber position. The straight-line portion of this curve was extrapolated to zero current to give the extrapolated ionization range. This result was normalized to 1 mm pressure and 15°C. The results of these measurements were unexpected. At a given pressure the normalized extrapolated ionization range R can be expressed as a function of the proton energy E in the form $R = KE^{3/2}$ where K is independent of range and energy. However the normalized range was found to depend on the pressure. This variation can be described for hydrogen by the empirical relation $1/K = 0.090 + 0.295 \exp(-5.1P)$ if the range is in centimeters, the energy in kilovolts and the pressure in mm of mercury. The corresponding expression for oxygen is $1/K = 0.233 + 0.676 \exp(-3.64P)$. The following possible explanation of the variation of K with pressure may be offered. Hydrogen atoms formed in the beam by protons capturing electrons may be initially in excited states. If the pressure is high the chance that an atom will reach its ground state before its next collision is small. Atoms remaining in excited states require about 3 ev or less for ionization. However, if the pressure is low an atom has a larger chance to reach the ground state. Atoms reaching the ground state will require about 13 ev for ionization. The average energy lost by a beam particle in the charge-exchange process will increase as the pressure decreases. Calculations based on apparently reasonable assumptions give qualitative agreement with experiment. (Entire report)

1340

Brookhaven National Lab.

ANALYSIS OF 14 MEV n–p SCATTERING; by George Snow. Nov. 9, 1951. 30p. (BNL-1036)

An abstract of this report was indexed as Report AECU-1602 and appeared in Nuclear Science Abstracts as NSA 5-5916.

1341

Watertown Arsenal

EXTINCTION EFFECTS IN NEUTRON TRANSMISSION OF POLYCRYSTALLINE MEDIA; by R. J. Weiss. [nd] 17p. (BNL-1084)

The effects of primary and secondary extinction are considered for neutron-transmission work in the diffraction-energy region. It is shown that the grain size is the most important parameter affecting extinction in typical studies, with the mosaic-block size and the angular spread of the mosaic blocks of secondary importance. Experiments were performed to corroborate the theory, and criteria are set up to avoid extinction effects. It is shown how to determine mosaic-block size and the angular spread of the mosaic blocks in large-grain substances by using fine resolution near the last Bragg cut-off peak. (auth)

1342

Knolls Atomic Power Lab.

ANGULAR DISTRIBUTION AND INTENSITY OF SECONDARY GAMMA RAYS; by G. A. Allard. Dec. 13, 1951. 20p. (KAPL-644)

This report elaborates a solution, already available in a simplified form, to the problem of secondary gamma radiation in reactor shields. A collimated neutron flux is assumed to impinge normally on an infinitely extended slab of shielding material and to undergo an exponential attenuation. Each attenuating process is assumed to generate a gamma photon of definite energy, with an isotropic probability of directional distribution. The problem solved here is the calculation of the current and angular distribution of secondary gamma rays at the slab face opposite the one entered by the original neutron flux. (auth)

1343

Atomic Energy Project, Univ. of Calif., Los Angeles

ENERGY ADSORPTION BY EXTERNALLY IRRADIATED LIQUIDS; by Stanley L. Whitcher. Issued Dec. 20, 1951. 44p. (UCLA-174)

Absorption of energy by liquids which are being exposed to high energy radiation through the wall of a containing vessel is dependent on the size of the sample, the heterogeneity of the incident beam, the absorption coefficients of the medium and the material of the container wall. Direct determination by accurate physical methods is difficult and the conversion from ionization chamber measurements made at the sample position in the radiation field is subject to some uncertainty. Some equations and calculations are given which would be expected to be approximately correct under favorable conditions and a discussion is presented of certain factors which hinder the development of more generally applicable expressions. The advantages of chemical dosimeters for monitoring the irradiation of aqueous solutions are considered together with some methods for the calibration of such systems. (auth)

1344

Radiation Lab., Univ. of Calif.

THE SELF-SCATTERING AND SELF-ABSORPTION OF BETA PARTICLES BY MODERATELY THICK SAMPLES; by W. E. Nervik and P. C. Stevenson. Nov. 21, 1951. 23p. (UCRL-1575)

A study has been made of the effect of moderately thick samples on the observed counting rate of β-active isotopes. Homogeneous mixtures of inactive salt and carrier-free active material having a single-component β spectrum were mounted in uniform deposits on steel plates, and the counting rate was observed as the thickness of inactive salt was varied between 1 and 20 mg/cm^2. The effect has been measured for six active isotopes having maximum β energies between 0.167 and 2.2 Mev. The isotopes used were S^{35}, Pm^{147}, W^{185}, Pr^{143}, P^{32}, and Y^{90}, and the salts for which data were obtained were NaCl, $Pb(NO_3)_2$, and (in the case of P^{32} only) $Tl(NO_3)$. When compared to the counting rate of carrier-free active material, all thick samples except the 0.167-Mev β in NaCl show an initial rise in the observed counting rate, followed by a gradual decrease as the sample thickness increases. This is interpreted to mean that scattering of β particles into the Geiger counter is the preferential process at low sample thicknesses and that absorption of β particles by the sample gradually becomes more important as the sample thickness is increased.

1345

ON SEVERAL APPROXIMATE RELATIONS BETWEEN THE ENERGY, SPECIFIC IONIZATION, AND RANGE OF A HIGH-ENERGY PARTICLE. Anatole Rogozinski. J. phys. radium 12, 955-6(1951) Dec. (In French)

Simple approximate relations are given between the energy E, the range R, and the specific ionization $K = dE/dR$ of protons in Al for portions of the energy range 10 to 10,000 Mev. These are generalized to the case of any particle of mass M and charge eZ by the equation $E = aM^{0.44} Z^{1.12} R^{0.56}$, valid for $0.1 < \beta < 0.85$, where $\beta = v/c$. The constant a = 27.5 for Al and 29.0 for air.

1346

CALCULATION OF THE RECTANGULAR POTENTIAL WELL FOR NEUTRON-PROTON INTERACTION FROM

EXPERIMENTS. Friedrich Katscher. Acta Phys. Aust. 5, 89-122(1951) Nov. (In German)

The breadth and depth of the neutron-proton interaction potentials for singlet and triplet states have been calculated from the binding energy of the deuteron and from experimental scattering cross sections. Measurements of the coherent scattering amplitude permitted a selection to be made among the infinite number of possible dimensions. The resulting rectangular potential well is compared with that for proton-proton interaction.

1347

X-RAY SCATTERING BY AGGREGATES OF BONDED ATOMS. I. ANALYTICAL APPROXIMATIONS IN SINGLE-ATOM SCATTERING. R. McWeeny. Acta Cryst. 4, 513-19(1951) Nov.

An approach is made to the problem of calculating atomic scattering factors for real atoms in which both inherent departures from sphericity and the effects of bonding are taken into account. An 'effective' scattering factor for a bonded atom may be defined; the main contribution to this factor is the atomic scattering factor usually employed. In this paper analytical approximations to atomic wave functions are used in order to obtain closed expressions for the scattering factors of atoms H, He, Li, Be, B, C, N, O, F, and Ne. For those atoms which are non-spherical the scattering is dependent on atomic orientation; but it is easily described in terms of two 'principal scattering factors.' There are significant differences between the results of these calculations and those given many years ago by James & Brindley (Phil. Mag. (7) 12, 81(1931)). (auth)

1348

ON THE SCATTERING OF β RAYS. Maurice Spighel. Compt. rend. 233, 1358-60(1951) Nov. 26. (In French)

In order to check the conclusion of Yuasa and Radvanyi (Compt. rend. 232, 1348, 1417(1951); NSA 5-6464, 5-6465) that the properties of β radiation change on traversing matter, the author has measured the percentage of P^{32} β particles scattered at angles >5° by Au foils, with and without a 10-mg/cm^2 polyvinyl sheet in front of the source. Scattering was measured at energies of 400 and 830 kev with a G-M counter. Except for an unexplained slight systematic difference, the presence of the screen did not affect the results. However, the source was thicker than the one previously used, and the source-scatterer distance was greater, 21 cm contrasted to 4 to 7 cm.

RADIATION EFFECTS

1349

EVIDENCE FOR PRODUCTION OF HOLE TRAPS IN GERMANIUM BY FAST NEUTRON BOMBARDMENT. J. W. Cleland, J. H. Crawford, Jr., K. Lark-Horovitz, J. C. Pigg, and F. W. Young, Jr. Phys. Rev. 84, 861-2(1951) Nov. 15.

The conductivity of five low-resistivity P-type Ge single crystals was followed during fast-neutron bombardment in the Oak Ridge pile. The initial rate of change in carrier concentration per incident neutron, the original hole concentration, and the exposure temperature for each of these samples are tabulated. All samples showed a decrease in conductivity with bombardment and a gradual approach to a limiting value. Several samples with hole concentrations of ~10^{16} per cm^3 were bombarded at −78°C and the conductivity was followed at that temperature and at 55°C after the dry ice was sublimed. A typical conductivity vs. integrated fast-neutron flux $(nvt)_{fast}$ curve is shown. In every case the slope is negative at −78°C and positive at 55°C in agreement with theory. The limiting or saturation value of the Fermi level (ζ_{limit}) is shown to be 0.168 ev > ζ_{limit} > 0.105 ev.

1350

DIRECT EVIDENCE FOR THE CONDUCTIVITY OF A THIN DIELECTRIC SUBJECTED TO AN ELECTRON BOMBARDMENT. Ch. Dufour, A. Herpin, and J.-P. Thomas. J. phys. radium 12, 887-8(1951) Nov. (In French)

A circuit by which the current induced in a thin layer of dielectric by electron bombardment (~10,000-v electrons) may be measured directly is described briefly. The dielectric studied consisted of an Al-ZnS-Al triple layer deposited on a glass support by evaporation, the metallic layers being only 30-mμ thick. The ratio of dielectric to primary current is plotted against the polarization voltage, and variations in the induced current are discussed.

RADIOACTIVITY

1351

THE GAMMA-RAY SPECTRA OF K^{38} AND Cl^{34}. Harold K. Ticho. Phys. Rev. 84, 847-8(1951) Nov. 15.

By means of a scintillation γ-ray spectrometer some preliminary results on the energies of the γ rays of Cl^{34} (33 min) and K^{38} (7.5 min) have been obtained. The activities were produced by (p,pn) reactions on bombardment of NaCl and KI by 18-Mev protons. The apparatus was calibrated with the 1.28-Mev γ ray of Na^{22}. The features of the K^{38} oscilloscope pattern, of which a photograph is shown, are interpreted as photoline, pair-line, and Compton distribution of a single γ of 2.16 ± 0.03 Mev. The photolines and pair-lines from the γ rays of Cl^{34} overlap, but γ-ray energies of 3.22 ± 0.03, 2.10 ± 0.03, and 1.16 ± 0.03 Mev were computed from microdensitometer tracings.

1352

ORDER OF GAMMA-RAY EMISSION IN THE DECAY OF In^{111}. M. M. Miller, C. H. Pruett, R. G. Wilkinson. Phys. Rev. 84, 849-50(1951) Nov. 15.

The correspondence between the Cd^{111} 0.08 μsec level at 247 kev and the 247-kev γ ray associated with the decay of In^{111} has been established directly. By introduction of delays into the circuit of one of two scintillation spectrometers in coincidence, it was shown that the 247-kev γ is delayed with respect to the 172-kev γ.

1353

THE DECAY SCHEME OF ZINC-65. S. E. Furberg. Nature 168, 1005-6(1951) Dec. 8.

A very small percentage of the Zn^{65} decays are by positron emission (<2.2%), the main mode of decay being by K capture. The branching ratio between the capture processes leading to the 1.11-Mev excited state of Cu^{65} and those leading directly to the ground state has been investigated. A selective method based on variation of counter efficiency with gas pressure was used for detection of the x rays. A calibrated γ counter and an x-γ coincidence counter were also used. The branching ratio p is defined as $p = K_2/(K_1 + K_2)$, where K_1 = number of capture processes leading to the ground state and K_2 = number leading to the excited state. p was found to be 0.44 ± 0.03.

1354

THE DECAY OF Co^{61}. L. A. Smith, R. N. H. Haslam, and J. G. V. Taylor. Phys. Rev. 84, 842-3(1951) Nov. 15.

The decay of Co^{61}, from the reactions $Cu^{65}(\gamma,\alpha)Co^{61}$ and $Ni^{62}(\gamma,p)Co^{61}$, has been followed for ten half lives. Two β particles were found, one with a maximum energy of 1.42 ± 0.02 Mev (55 ± 10%) and the other with a maximum energy of 1.00 ± 0.02 Mev (45 ± 10%). A γ ray of ~0.5 Mev was also indicated. The simplest decay scheme on the basis of these results shows the 1.42-Mev β going from the ground state of Co^{61} to that of Ni^{61}, and the 1.00-Mev β leading to an excited state of Ni^{61} which decays to ground by emitting a 0.42-Mev γ.

1355
REMARK ON A RECENT MEASUREMENT OF THE HALF LIFE OF Ru^{87}. Georges Charpak and Francis Suzor. Compt. rend. 233, 1356-7(1951) Nov. 26. (In French)

Curran et al. (Phys. Rev. 84, 151(1951); NSA 5-7329) measured the half life of Rb^{87} as 6.15×10^{10} yr with a cylindrical Al proportional counter, on the interior surface of which was deposited RbCl. A correction of 7.5% was made for reflection by the Al wall. The present investigators have measured the back scattering of electrons through a solid angle of 2π (J. phys. radium, in press) and conclude that the correction should have been 33%. This leads to a value for the Rb^{87} half life of $(7.6 \pm 0.4) \times 10^{10}$ yr.

1356
THE BETA-RAY SPECTRA OF Tm^{170} AND RaE. Seitaro Nakamura, Minoru Umezawa, and Hisao Takebe. Phys. Rev. 84, 865-6(1951) Nov. 15.

An attempt is made to interpret the β spectra of Tm^{170} and RaE(Bi^{210}) in order to test the Fermi theory of β decay. The forbidden Fermi plot in C_{1T} of Tm^{170} is straight from $W_0 = 2.95\ mc^2$ down to $W = 1.5\ mc^2$ if k_{1T} is taken to be 10.3; the forbidden Fermi plot in C_{1V} is straight from W_0 down to $W = 1.3\ mc^2$ if $k_{1V} = 10.5$. It appears that the spin 3 and odd-parity ground state of Tm^{170} decays to the excited state of Yb^{170}, whose spin is 2 and parity is even, accompanied by the 85.4-kev γ emission leading to the ground state of Yb^{170}, whose spin is 0 and parity is even. The ft value of Tm^{170} was evaluated by the forbidden f-function, and found to be 4.2×10^9. The first-forbidden cases for RaE are reinvestigated. $\Delta J = \pm 2$ and $\Delta J = 0$ are rejected. $\Delta J = \pm 1$ involves a linear combination of several matrix elements; any real value for the ratio of the nuclear matrix elements, k_{1T} or k_{1V}, cannot yield the required shape.

1357
PRECISE MEASUREMENT OF THE HALF LIVES OF SEVERAL RADIOELEMENTS. Jacques Tobailem. Compt. rend. 233, 1360-2(1951) Nov. 26. (In French)

The following half lives have been measured by a differential ionization method: Rn^{222}, 3.825 ± 0.005 days; Fe^{59}, 47.1 ± 0.5 days; Co^{60}, 5.27 ± 0.07 yr; Ga^{67}, 77.9 ± 0.3 hr.

1358
RADIOACTIVITY STUDIES ON THE SUMMIT OF PUY dE DOME. Hubert Garrigue. Compt. rend. 233, 1447-8 (1951) Dec. 3. (In French)

No radioactivity was detected in the first snows of the winter on the Puy de Dôme, 1465 m. In snow falling during the night of Nov. 19-20, 1951, radioactivity was found, including a new atmospheric activity, probably complex, with an apparent half life of ~10 days. The author designates this as substance A″.

RARE EARTHS AND RARE-EARTH COMPOUNDS

1359
PARAMAGNETIC RESONANCE ABSORPTION IN Ce(III) AND Nd(III) SULFATES. V. Ya. Kurenev and S. G. Salikhov. Zhur. Eksptl'. i Teoret. Fiz. 21, 864-8(1951) Aug. (In Russian)

The paramagnetic resonance absorption of $Ce_2(SO_4)_3$, $Nd_2(SO_4)_3$, and their hydrates has been studied at 2.38×10^8 and 6.75×10^8 cycles/sec in a 20- to 1400-gauss magnetic field at 90 and 293 to 302°K. At room temperature all absorption curves had a single maximum, except the double-peaked curve for $Ce_2(SO_4)_3.8H_2O$. At the higher frequency, the maximum was displaced toward greater magnetic field strength. At 90°K two maxima were observed in all cases. 4 figures.

SHIELDING

1360
Oak Ridge National Lab.
NUCLEAR RADIATION SHIELDING PRINCIPLES, p.332-352 of THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; by E. P. Blizard. Dec. 1951. (TID-5031(p.332-352))

A few of the principles governing shielding of nuclear radiation are discussed. The application of the principles is described. It is to the credit of the scientists and engineers on the Manhattan Project that all the reactors were adequately shielded as built, and no fundamental changes were required after the initial construction in any case. As might be expected, all designs which erred did so on the conservative side, but for mobile reactors overdesign can no longer be tolerated.

THEORETICAL PHYSICS

1361
INTERACTION BETWEEN MATTER AND RADIATION IN THE REGION OF THE OPTICAL RESONANCE. S. Kichenassamy. J. phys. radium 12, 863-7(1951) Nov. (In French)

A new interpretation of the quadratic term of the vector potential in the nonrelativistic expression for the interaction Hamiltonian of the electron-radiation system is proposed. It is shown that this permits theoretical prediction of Lennuier's experimental results (Ann. phys. 2, 233(1947); J. chim phys. 46, (1949)) on scattering in the region of optical resonance.

1362
CHARGE-RENORMALIZATION ACCOMPANYING RADIATIVE CORRECTIONS. M. Demeur. Nature 168, 1037-8 (1951) Dec. 15.

Introduction of a "bound interaction representation" into quantum electrodynamics indicates the connection between charge infinities and vacuum polarizations. Another advantage is that radiative corrections need not be developed in powers of the external field. The case of a homogeneous and constant magnetic field can be treated completely. The self-energy in the square of the coupling constant gives a mass renormalization term and a term which is the total magnetic radiative correction. The development in powers of the magnetic field converges very rapidly. The ratio of the magnetic polarizability to the magnetic moments is of the order of 10^{-14}. For nucleons with pseudoscalar coupling the terms are finite and converge more rapidly. The ratio of the magnetic polarizability to the magnetic moment is of the order of 10^{-21}. Similar calculations for self-energies in the fourth power of the coupling constant are being made.

1363
ATTEMPTS TO USE WAVE MECHANICS IN PHOSPHORESCENCE. Daniel Curie. J. phys. radium 12, 920-9 (1951) Dec. (In French)

The use of wave mechanics does not lead to exact deduction of the wave functions of electrons in traps and conduction bands, but it does give a deep insight into the validity of various hypotheses on the nature of the traps and the mechanism of escape. Muto's theory, in which the trap consists of a single metastable state below the conduction band and escape is accomplished by absorption of a single quantum of thermal energy, is discussed first. The principle may be retained if a small proportion of waves having frequencies greater than the Debye frequency is present. An electron can also escape by absorbing several thermal quanta in succession. Other theories are discussed. It is shown that the electron about to escape from a trap is local-

ized and can be described by a packet of Bloch functions increasing rapidly. The spatial distribution of traps is significant in phosphorescent decay.

1364
THEORETICAL STUDIES IN NUCLEAR STRUCTURE. IV. WAVE FUNCTIONS FOR THE NUCLEAR p-SHELL. PART A. $\langle p^n | p^{n-1} p \rangle$ FRACTIONAL PARENTAGE COEFFICIENTS. H. A. Jahn and H. Van Wieringen. Proc. Roy. Soc. (London) 209A, 502-24(1951) Nov. 22.

A complete set of wave functions is constructed for the whole of the nuclear p-shell (from p^3 to p^{12}). Following Racah, the wave functions for p^n are expressed as linear combinations of totally antisymmetric wave functions for p^{n-1}, vector-coupled to the wave functions of the remaining particle. The coefficients in the linear combination are expressed as the product of an orbital coefficient, a charge-spin coefficient and a weight factor equal to the square root of the ratio of the dimensions of two irreducible representations of permutation groups. Using the Young-Yamanouchi orthogonal representation of the permutation group, the orbital and charge-spin coefficients may be calculated independently. Specialization of the new method to the atomic p-shell and an alternative direct method of calculating the total parentage coefficients are described in the appendices. A reciprocal relation for the special unitary group, simplifying the calculation of both the orbital and the charge-spin coefficients, is described in an addendum. (auth)

1365
ON GRADIENT INVARIANCE IN VACUUM THEORY. D. A. Kirzhnits. Zhur. Eksptl'. i Teoret. Fiz. 21, 949-51 (1951) Aug. (In Russian)

Certain aspects of vacuum polarization of a magnetic field are applied to criticism of calculations of Abrikosov and Khalatnikov (Zhur. Eksptl'. i Teoret. Fiz. 21, 1, 69-78 (1951); NSA 5-3793) on the interaction of an electron with its own radiation field.

1366
CERTAIN RESULTS IN THE GENERALIZED THEORY OF FIELDS. V. I. Rodichev. Zhur. Eksptl'. i Teoret. Fiz. 21, 869-78(1951) Aug. (In Russian)

The theory of the electromagnetic field is generalized to include the case of self-energy not equal to zero. This is achieved by introducing a complementary variable s = self-time and the component A_0 of the vector potential. The derived field equations are gage invariant and permit determination of the probable value of the self-energy and the mass spectra of spin-1 particles. Quantized fields, amplitude fields, and Maxwell fields are related.

1367
ON THE OPEN CHARACTER OF WAVE MECHANICS. Paulette Destouches-Février. Compt. rend. 233, 1430-2 (1951) Dec. 3. (In French)

A wave mechanics, which is an essentially indeterministic theory, is an open theory in the sense that one may always imagine that certain quantities have been disregarded which would be taken into account in a more complete theory of the same structure. A deterministic theory is closed in this sense. The general properties of a deterministic theory are compared with those of a wave mechanics.

1368
ON THE DISTINCTION BETWEEN PARTICLES AND ANTI-PARTICLES OBEYING DIRAC'S EQUATION. M. A. Markov. Zhur. Eksptl'. i Teoret. Fiz. 21, No. 7, 761-9(1951) July. (In Russian)

Equations for the interactions of Dirac particles and anti-particles, such as electron and positron, with neutral and charged meson fields are derived to indicate the distinction between such particles. Distinction between neutrino and antineutrino is particularly considered.

1369
MULTIPOLES OF THE MESON FIELD. W. Franz and L. Tewordt. Z. Physik 130, No. 4, 457-67(1951). (In German)

The general multipole solutions for the Kemmer meson in a central electrostatic field are derived. Three spin-1 possibilities correspond to each value of angular momentum and its z component of the vector meson, a longitudinal and two transverse multipoles. Only one longitudinal multipole corresponds to the spin 0 of a scalar meson.

1370
FORCED VIBRATIONS OF THE HARMONIC OSCILLATOR ACCORDING TO QUANTUM THEORY. Günther Ludwig. Z. Physik 130, No. 4, 468-76(1951). (In German)

The motion of a harmonic oscillator under the influence of a force $eF(t)$ is solved exactly for arbitrary $F(t)$. Dirac's approximation method is used to develop the solution in a power series of the coupling constant e.

AUTHOR INDEX

For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number.

AUTHOR INDEX

NUMERICAL INDEX OF REPORTS

Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list in the individual issues of Volume 6 supplements the Numerical Index of Reports with Indications of Their Availability which appears in NSA, Volume 5, No. 24. As reports are in manuscript form when abstracted for NSA, there may be some delay before the reports will be available at the Depository Libraries. The notation NSA in the Availability column indicates the appearance of a report in its entirety in NSA.

Abbreviations used below are:

NSA - NUCLEAR SCIENCE ABSTRACTS

ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA

NNES - National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:

MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948

AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)

AECU - To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

Other code designations below are assigned to unclassified reports by the originating installations

Report	Abstract	Availability
ECD-3251	NSA 5-6907	Phys. Rev. 84, 1264-5(1951)
ECU-927	4-6723	J. Am. Chem. Soc. 73, 5715-17(1951)
1172	5-2786	J. Am. Chem. Soc. 73, 5577-9(1951)
1268	5-3270	Phys. Rev. 84, 1079-83(1951)
1284	5-3443	J. Am. Ceram. Soc. 35, 15(1952)
1545	5-5189	J. Applied Phys. 22, 1290-91(1951)
1549	5-5123	Science 114, 443-4(1951)
1556	5-5227	Phys. Rev. 84, 1263(1951)
1571	5-5373	Phys. Rev. 84, 1124-9(1951)
1599	5-5512	Am. J. Physiol. 167, 345-8(1951)
1679	6-124	NSA
1693	6-149	NSA
1698	6-150	NSA
1682	6-140	NSA
1683	6-101	NSA
1686	6-45	NSA
1687	6-2	NSA
1688	6-148	NSA
1689	6-46	NSA
1690	6-47	NSA
1691	6-25	NSA
1692	6-3	NSA
1694	6-48	NSA
1695	6-26	NSA
1696	6-27	NSA
1697	6-4	NSA
1699	6-49	NSA
1700	6-79	NSA
1704	6-335	Phys. Rev. 84, 379-80(1951)
1705	6-29	NSA
1706	6-5	NSA
1707	6-293	NSA
1708	6-111	NSA
1715	6-7	Proc. Soc. Exptl. Biol. Med. 78, 338-42 (1951)
1716	6-8	Evolution 4, No. 2, 172-4(1950)
1723	6-84	J. Electrochem. Soc. 98, 443-6(1951)
1724	6-102	J. Am. Chem. Soc. 73, 3989-91(1951)
1733	6-1046	NSA
1736	6-567	NSA
1737	6-534	NSA
AECU-1739	NSA 6-540	NSA
1752	6-530	NSA
1755	6-759	NSA
1768	6-499	NSA
1775	6-1047	NSA
1779	6-851	NSA
1781	6-1048	NSA
1788	6-980	NSA
1789	6-955	NSA
1805	6-843	NSA
AERE-C/R-758	6-358	NSA
BNL-1002	6-292	NSA; Phys. Rev. 84, 1052(1951)
1017	6-316	Phys. Rev. 84, 1247-8(1951)
1021	6-626	NSA
ISC-146	6-86	$0.20
164	6-157	0.25
179	5-7145	Phys. Rev. 84, 1256-7(1951)
K-612	4-5192	J. Am. Chem. Soc. 73, 5725-7(1951)
KAPL-638	6-107	Anal. Chem. 23, 1709-10(1951) Nov.
NP-1615	4-5491	Phys. Rev. 84, 1169-77(1951)
NYO-3033	6-338	Phys. Rev. 84, 1249(1951)
3450	6-211	$0.25
ORO-47	5-6198	0.35
UCLA-151	5-4948	Proc. Soc. Exptl. Biol. Med. 78, 147-9 (1951)
UCRL-639	4-5909	J. Metals (N. Y.) 4, 33(1951)
1412	6-168	$0.10
1429	6-152	NSA
1443	5-5820	Phys. Rev. 84, 1084-9(1951)
1483	6-153	NSA
1508	6-715	NSA
1511	6-289	NSA

Report	Abstract	Availability
UCRL-1512	NSA 6-284	NSA
1515	6-412	NSA
1516	6-413	NSA
1519	6-361	NSA
1520	6-388	NSA
1521	6-362	NSA
1522	6-319	NSA
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1525	6-321	NSA
1527	6-390	NSA
1528	6-298	NSA
1529	6-322	NSA
1530	6-669	NSA
1531	6-363	NSA
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1535	6-656	NSA
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1547	6-737	NSA
1551	6-702	NSA
1552	6-703	NSA
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1555	6-718	NSA
1556	6-687	NSA
1579	6-521	NSA
1593	6-1004	NSA
1595	6-974	NSA
1603	6-1005	NSA
1684	6-162	NSA

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 1, page "SUPPLEMENT 1".

H^3	β^- intensity below 1 kev less than expected	G. M. Insch, S. C. Curran, Phil. Mag. 42, 892(1951).
Be	σ_t(156 Mev) 0.26	A. E. Taylor et al., Phil. Mag. 42, 751(1951).
$_4Be_4^8$	Level $C^{12}(\gamma,3\alpha)$ 16.9 ppl	J. J. Wilkins, F. K. Goward, Proc. Phys. Soc. (London) 64A, 1056 (1951).
$_5B_5^{10}$	Level $C^{12}(d,\alpha)$ 0.71 s	A. Ashmore, J. F. Raffle, Proc. Phys. Soc. (London) 64A, 754 (1951).
$_6C_6^{12}$	$C^{12}(\gamma,3\alpha)$ ppl $E_0 \sim 27$	J. J. Wilkins, F. K. Goward, Proc. Phys. Soc. (London) 64A, 1056 (1951).
$_7N_8^{13}$	d,n(θ) C^{12}(d,n) I(3.53 level)=3/2+,5/2+ I(2.38 level)=1/2+ I(ground)=1/2-,3/2-	F. A. El-Bedewi et al., Proc. Phys. Soc. (London) 64A, 1055 (1951).
$_7N_7^{14}$	Levels O^{16}(d,α) 3.95, 5.01, 5.70 s	A. Ashmore, J. F. Raffle, Proc. Phys. Soc., (London) 64A, 754 (1951).
$_9F_8^{17}$	d,n(θ) O^{16}(d,n) I(0.53 level)=1/2+ I(ground)=3/2+,5/2+	F. A. El-Bedewi et al., Proc. Phys. Soc. (London) 64A, 757 (1951).
$_{14}Si_{15}^{29}$	μ −0.55492* I assumed I=1/2	S. S. Dharmatti, H. E. Weaver, Jr., Phys. Rev. 84, 843(1951). * Based on $\mu(H^1)$ = 2.7934; $\nu(H^2)/\nu(H^1)$ = 0.153506; $\nu(Na^{23})/\nu(H^1)$ = 0.26450.
$_{17}Cl_{17}^{34}$	γ 1.16 scin 2.10 3.22	H. K. Ticho, Phys. Rev. 84, 847(1951). Cl(18 Mev p,pn).
$_{19}K_{19}^{38}$	γ 2.16 scin	H. K. Ticho, Phys. Rev. 84, 847(1951). K(18 Mev p,pn).
Ti	σ_t(14 Mev) 2.25	L. S. Goodman, ANL-4602 (Mar. 1951).
V	σ_s(0.0017 ev) 6 σ_t(0.0017 ev) 4.7	P. A. Egelstaff, Nature 168, 290(1951).
V	σ_t(14 Mev) 2.38	L. S. Goodman, ANL-4602 (Mar. 1951).
Cr	σ_t(14 Mev) 2.33	L. S. Goodman, ANL-4602 (Mar. 1951).
Fe	σ_s(0.0017 ev) 1.5 σ_t(0.0017 ev) 1.4	P. A. Egelstaff, Nature 168, 290(1951).
Fe	σ_t(14 Mev) 2.33	L. S. Goodman, ANL-4602 (Mar. 1951).
	σ_t(156 Mev) 1.24	A. E. Taylor et al., Phil. Mag. 42, 751(1951).
$_{27}Co_{34}^{61}$	γ 99.0^m β^- 45% 1.00 a 55% 1.42 γ ~0.5	L. A. Smith et al., Phys. Rev. 84, 842(1951). Cu(γ,α); Ni(γ,p); chem.
Ni	σ_t(14 Mev) 2.41	L. S. Goodman, ANL-4602 (Mar. 1951).
Cu	σ_t(14.2 Mev) 2.85	D. I. Meyer, W. Nyer, LA-1279 (July 1951).
	σ_t(156 Mev) 1.38	A. E. Taylor et al., Phil. Mag. 42, 751(1951).
$_{29}Cu_{34}^{63}$	q −0.13 para $q(Cu^{63})/(Cu^{65})$ = 1.08	B. Bleaney et al., Proc. Phys. Soc. (London) 64A, 758(1951).
$_{29}Cu_{36}^{65}$	q −0.12 para	B. Bleaney et al., Proc. Phys. Soc. (London) 64A, 758(1951).
Zn	σ_t(14 Mev) 2.88	L. S. Goodman, ANL-4602 (Mar. 1951).

Se	σ_s(0.0017 ev)	2	P. A. Egelstaff, Nature 168, 290(1951).
	σ_t(0.0017 ev)	4	
$_{35}Br^{74?}_{39}$	τ 35^m		J. M. Hollander, UCRL-1396 (July 1951). Cu(C,3n); chem.
	long-lived or stable daughter		
$_{35}Br^{75?}_{40}$	τ 95^m		J. M. Hollander, UCRL-1396 (July 1951). Cu(C,2n); chem.
	β^+ ~1.8	a	
$_{35}Br^{76}_{41}$	τ 16.5^h		J. M. Hollander, UCRL-1396 (July 1951). As(33 Mev α,3n); chem.
	β^+ 3.5	s	
$_{35}Br^{77}_{42}$	τ 57^h		J. M. Hollander, UCRL-1396 (July 1951). As(24 Mev α,2n); chem.
	β^+ 0.4	s	
	e^- 0.35	s	
	γ ~0.3,~0.8		
$_{35}Br^{79}_{44}$	q +0.30	I	H. G. Dehmelt, Z. Physik 130, 480(1951).
	q +0.31	Mic	W. Gordy, J. Chem. Phys. 19, 792(1951).
$_{35}Br^{81}_{46}$	q +0.25	I	H. G. Dehmelt, Z. Physik 130, 480(1951).
	q +0.26	Mic	W. Gordy, J. Chem. Phys. 19, 792(1951).
Mo	σ_s(0.0017 ev)	<0.3	P. A. Egelstaff, Nature 168, 290(1951).
	σ_t(0.0017 ev)	<0.3	
Mo	σ_t(14 Mev) 3.6		L. S. Goodman, ANL-4602 (Mar. 1951).
$_{49}In^{111}_{62}$	(0.172γ)(0.247γ) ~0.1$^{\mu s}$ delay		M. M. Miller et al., Phys. Rev. 84, 849 (1951).
Sn	σ_t(14 Mev) 4.02		L. S. Goodman, ANL-4602 (Mar. 1951).
Sb	σ_t(14 Mev) 4.6		L. S. Goodman, ANL-4602 (Mar. 1951).
Sb	q coupling ratio Sb^{123}/Sb^{121}=1.2751	I	H. G. Dehmelt, H. Kruger, Z. Physik 130, 385(1951).
$_{52}Te^{123}_{71}$	μ −0.73209*	I	S. S. Dharmatti, H. E. Weaver, Jr., Phys. Rev. 84, 843(1951). * Based on $\mu(H^1)$ = 2.7934; $\nu(H^2)/\nu(H^1)$ = 0.153506; $\nu(Na^{23})/\nu(H^1)$ = 0.26450.
$_{52}Te^{125}_{73}$	μ −0.88261*	I	S. S. Dharmatti, H. E. Weaver, Jr., Phys. Rev. 84, 843(1951). * Based on $\mu(H^1)$ = 2.7934; $\nu(H^2)/\nu(H^1)$ = 0.153506; $\nu(Na^{23})/\nu(H^1)$ = 0.26450.
$_{53}I^{125}_{72}$	τ 60.0^d		G. Friedlander, W. C. Orr, Phys. Rev. 84, 484 (1951). Conclude all decay to 0.035 level, E_{dis} ~ 0.115.
	K 77% L 23%		
	γ 0.035 pc		
	<0.05% decay to 58^{m}Te		
$_{53}I^{127}_{74}$	q −0.65	Mic	W. Gordy, J. Chem. Phys. 19, 792(1951).
$_{53}I^{128}_{75}$	Te K X-rays	scin	W. B. Mims, H. Halban, Proc. Phys. Soc. (London) 64A, 753 (1951).
	K/β^-=0.063		
	No Xβ coincidences		
$_{53}I^{129}_{76}$	q −0.47	Mic	W. Gordy, J. Chem. Phys. 19, 792(1951).
Ba	σ_t(156 Mev) 2.48		A. E. Taylor et al., Phil. Mag. 42, 751(1951).
W	σ_t(14 Mev) 4.62		L. S. Goodman, ANL-4602 (Mar. 1951).
Pb	σ_t(14 Mev) 5.0		L. S. Goodman, ANL-4602 (Mar. 1951).
	σ_t(156 Mev) 3.50		A. E. Taylor et al., Phil. Mag. 42, 751(1951).
Bi	σ_t(14 Mev) 5.13		L. S. Goodman, ANL-4602 (Mar. 1951).

Q's Between Ground States

$Li^6(\gamma,n)Li^5$	−5.35 ± 0.20	R. Sher, et al., Phys. Rev. 84, 387(1951). Detected n's in BF_3 counters.
$B^{10}(\gamma,n)B^9$	−8.55 ± 0.25	
$B^{11}(\gamma,n)B^{10}$	−11.50 ± 0.25	
$Na^{23}(\gamma,n)Na^{22}$	−12.05 ± 0.20	
$Mg^{24}(\gamma,n)Mg^{23}$	−16.55 ± 0.25	
$Mg^{25}(\gamma,n)Mg^{24}$	−7.25 ± 0.20	
$Mg^{26}(\gamma,n)Mg^{25}$	−11.15 ± 0.20	
$Al^{27}(\gamma,n)Al^{26}$	−12.75 ± 0.20	
$Si^{29}(\gamma,n)Si^{28}$	−8.45 ± 0.20	
$P^{31}(\gamma,n)P^{30}$	−12.05 ± 0.20	
$S^{34}(\gamma,n)S^{33}$	−10.85 ± 0.20	
$Cl^{35}(\gamma,n)Cl^{34}$ / $Cl^{37}(\gamma,n)Cl^{36}$	−9.95 ± 0.20	
$V^{51}(\gamma,n)V^{50}$	−11.15 + 0.20	
$Cr^{52}(\gamma,n)Cr^{51}$	−11.80 ± 0.25	
$Cr^{53}(\gamma,n)Cr^{52}$	−7.75 ± 0.20	

$Mn^{55}(\gamma,n)Mn^{54}$	-10.00 ± 0.20	R. Sher, et al., Phys. Rev. 84, 387(1951). Detected n's in BF_3 counters.
$Fe^{56}(\gamma,n)Fe^{55}$	-11.15 ± 0.25	
$Fe^{57}(\gamma,n)Fe^{56}$	-7.75 ± 0.20	
$Co^{59}(\gamma,n)Co^{58}$	-10.25 ± 0.20	
$Cu^{63}(\gamma,n)Cu^{62}$	-10.85 ± 0.20	
$Cu^{65}(\gamma,n)Cu^{64}$	-9.75 ± 0.20	
$Zn^{64}(\gamma,n)Zn^{63}$	-11.65 ± 0.20	
$Zn^{66}(\gamma,n)Zn^{65}$	-11.15 ± 0.20	
$Zn^{67}(\gamma,n)Zn^{66}$	-7.00 ± 0.20	
$Zn^{68}(\gamma,n)Zn^{67}$	-10.15 ± 0.20	
$Ga^{69}(\gamma,n)Ga^{68}$	-10.10 ± 0.20	
$Ga^{71}(\gamma,n)Ga^{70}$	-9.05 ± 0.20	
$As^{75}(\gamma,n)As^{74}$	-10.10 ± 0.20	
$Se^{?}(\gamma,n)Se^{?}$	-7.30 ± 0.20	
$Se^{?}(\gamma,n)Se^{?}$	-9.35 ± 0.20	
$Br^{79}(\gamma,n)Br^{78}$	-10.60 ± 0.20	
$Br^{81}(\gamma,n)Br^{80}$	-9.95 ± 0.20	
$Sr^{86}(\gamma,n)Sr^{85}$	-9.50 ± 0.20	
$Sr^{87}(\gamma,n)Sr^{86}$	-8.40 ± 0.20	
$Sr^{88}(\gamma,n)Sr^{87}$	-11.15 ± 0.20	
$Nb^{93}(\gamma,n)Nb^{92}$	-8.70 ± 0.20	
$Mo^{?}(\gamma,n)Mo^{?}$	-6.75 ± 0.25	
$Mo^{?}(\gamma,n)Mo^{?}$	-7.95 ± 0.25	
$Ru^{?}(\gamma,n)Ru^{?}$	-7.05 ± 0.20	
$Ru^{?}(\gamma,n)Ru^{?}$	-9.50 ± 0.20	
$Rh^{103}(\gamma,n)Rh^{102}$	-9.35 ± 0.20	
$Pd^{?}(\gamma,n)Pd^{?}$	-7.05 ± 0.20	
$Pd^{?}(\gamma,n)Pd^{?}$	-9.35 ± 0.20	
$Ag^{109}(\gamma,n)Ag^{108}$	-9.05 ± 0.20	
$Cd^{113}(\gamma,n)Cd^{112}$	-6.55 ± 0.20	R. Sher, et al., Phys. Rev. 84, 387(1951). Detected n's in BF_3 counters.
$In^{115}(\gamma,n)In^{114}$	-9.05 ± 0.20	
$Sn^{118}(\gamma,n)Sn^{117}$	-9.10 ± 0.20	
$Sn^{119}(\gamma,n)Sn^{118}$	-6.60 ± 0.20	
$Sb^{121}(\gamma,n)Sb^{120}$	-8.95 ± 0.25	
$Sb^{123}(\gamma,n)Sb^{122}$		
$Te^{?}(\gamma,n)Te^{?}$	-6.50 ± 0.20	
$Te^{?}(\gamma,n)Te^{?}$	-8.55 ± 0.20	
$I^{127}(\gamma,n)I^{126}$	-9.10 ± 0.20	
$Cs^{133}(\gamma,n)Cs^{132}$	-9.05 ± 0.20	
$Ba^{?}(\gamma,n)Ba^{?}$	-6.80 ± 0.20	
$Ba^{?}(\gamma,n)Ba^{?}$	-8.55 ± 0.25	
$La^{139}(\gamma,n)La^{138}$	-8.80 ± 0.20	
$Ce^{140}(\gamma,n)Ce^{139}$	-9.05 ± 0.20	
$Ce^{142}(\gamma,n)Ce^{141}$	-7.15 ± 0.20	
$Ta^{181}(\gamma,n)Ta^{180}$	-7.55 ± 0.20	
$W^{?}(\gamma,n)W^{?}$	-6.25 ± 0.30	
$W^{?}(\gamma,n)W^{?}$	-7.15 ± 0.30	
$Re^{187}(\gamma,n)Re^{186}$	-7.30 ± 0.30	
$Ir^{193}(\gamma,n)Ir^{192}$	-7.80 ± 0.20	
$Pt^{194}(\gamma,n)Pt^{193}$	-9.50 ± 0.20	
$Pt^{195}(\gamma,n)Pt^{194}$	-6.10 ± 0.20	
$Pt^{196}(\gamma,n)Pt^{195}$	-8.20 ± 0.20	
$Au^{197}(\gamma,n)Au^{196}$	-7.90 ± 0.20	
$Tl^{203}(\gamma,n)Tl^{202}$	-8.80 ± 0.20	
$Tl^{205}(\gamma,n)Tl^{204}$	-7.55 ± 0.20	
$Pb^{207}(\gamma,n)Pb^{206}$	-6.75 ± 0.20	
$Pb^{208}(\gamma,n)Pb^{207}$	-7.30 ± 0.20	
$Bi^{209}(\gamma,n)Bi^{208}$	-7.40 ± 0.20	

AEC, Oak Ridge, Tenn., -W15914

AVAILABILITY OF AEC RESEARCH AND DEVELOPMENT REPORTS

The Reports Reference List indicates the declassified and unclassified research reports which are abstracted in this issue of Nuclear Science Abstracts.

Many of these reports are or will be published in the scientific and technical journals or in volumes of the National Nuclear Energy Series. Upon publication, the report is listed in the supplements to the Numerical Index of Reports, found in the back of each issue of Nuclear Science Abstracts.

Reports not intended for publication are sent to the AEC depository libraries listed below as soon as possible after being abstracted. (Some of this group are also for sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C., which will send price lists upon request.)

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More complete information is given in a pamphlet, "Availability of USAEC Research and Development Reports," which may be obtained upon request from the Technical Information Service, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

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- Chicago, University of Chicago Library
- Urbana, University of Illinois Library

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- Baton Rouge, Louisiana State University Library

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- Cambridge, Harvard University Library
- Cambridge, Massachusetts Institute of Technology Library

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- Detroit, Detroit Public Library

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- St. Louis, Washington University Library

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- New York, New York Public Library
- Troy, Rensselaer Polytechnic Institute

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- Columbus, Ohio State University Library

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- Nashville, Joint University Libraries

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